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American Machinist

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Uncle Sam's Machines

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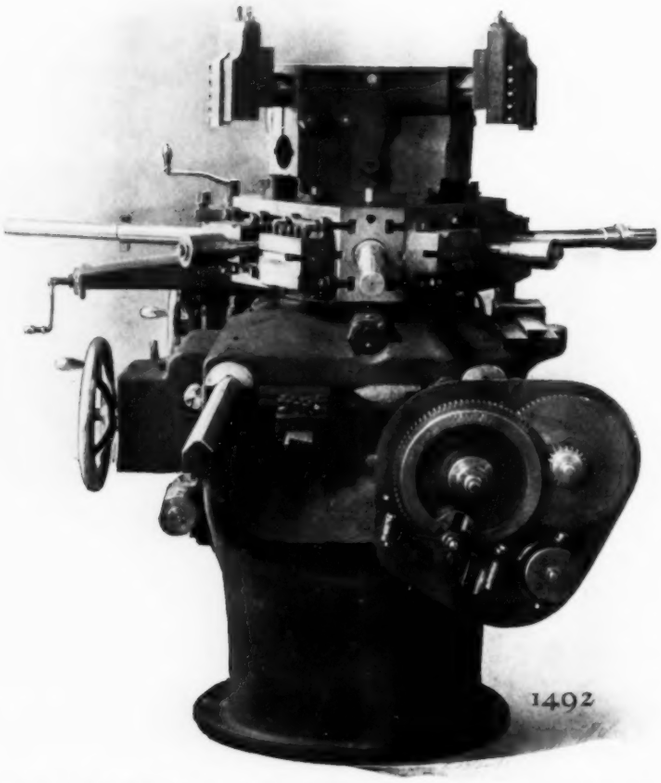
Automatic Turret Control
on the Pond Rigid Turret Lathe



Turret end of the 28-in. Pond Rigid Turret Lathe, showing turret with extension turret arranged for chuck work. End gear guards removed to show mechanism for automatically revolving turret.

Makes this machine remarkably easy to handle and very rapid in manipulation.

It permits the operator to direct all his energy toward increasing the output and promoting accuracy, and not in supplying the machine with useless power.

On the average hand operated, heavy turret lathe almost 75 per cent. of the operator's energy is used in manipulating the turret. Add to this a non-self-locking, hard running, slow responding turret, and how much energy has he left for the output?

This misdirected energy should be employed to increase the output, promote accuracy and maintain a cheerful operator by using

The Pond Rigid Turret Lathe

A large, powerful, massive machine that is sweeping the lathe field for rapid, heavy manufacture in duplicate.

The turret action on the Pond is entirely automatic, being controlled entirely by power. Change to hand manipulation can be instantly made at any time.

Write for Catalog "The Pond Rigid." It illustrates how to save money on numerous large castings that have generally been conceded impossible to machine in a turret lathe.

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(*See pages* 53, 54, 55, 56, 57, 58, 59 *and* 60)

Making Transformer Cases

Editorial Correspondence

Press for corrugating the sheets. Electric welding of longitudinal seam. Clamping sides into position for molders.

Pits in which to mold and cast the top and bottom, and apparatus and methods employed in molding.

In the transformers which are built by the General Electric Company in its Pittsfield, Mass., plant, the making of the case is an interesting series of operations owing to the fact that the side is made of corrugated sheet metal, while the top and bottom are made of cast iron. The iron is cast to this sheet metal so there is absolutely no leakage around the joints. The various operations in constructing the case are corrugating the sheets, welding longitudinal seams, clamping the corrugated sides so they will retain their proper shape when molding, molding and casting the top and bottom to the sheets and cleaning the castings.

The first operation is to cut the sheets to the proper size to form the sides of the case. After this, they are corrugated in a large press, as shown in Fig. 1.

Welding Sheets

After these sheets are corrugated, the two ends are brought together and a longitudinal seam is welded by the arc-welding process, as shown in Fig. 2. In the larger transformer sides two welders work at the same time on one joint. They start to weld in the center and carry it along to the outer edge.

After considerable experimenting, the company decided that this was the cheapest and most satisfactory method of making this joint. One of the main reasons for so deciding was that an absolutely tight joint could be easily and quickly made.

When the joint is welded the side of the case is clamped, as shown in Fig. 3. Two oval-shaped rings like the one shown at *A*, are placed inside the case under the bands *B B*, and the bands are then tightened up with the bolts shown. This gives the transformer side its proper shape and holds it rigid while it is having the top and bottom cast to it.

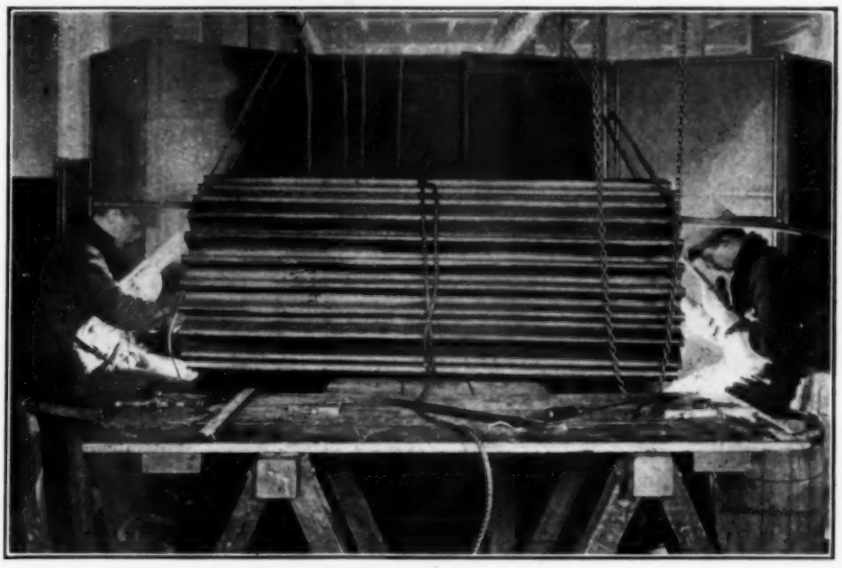


Fig. 2. Electric Welding the Longitudinal Seam in Corrugated Sheets

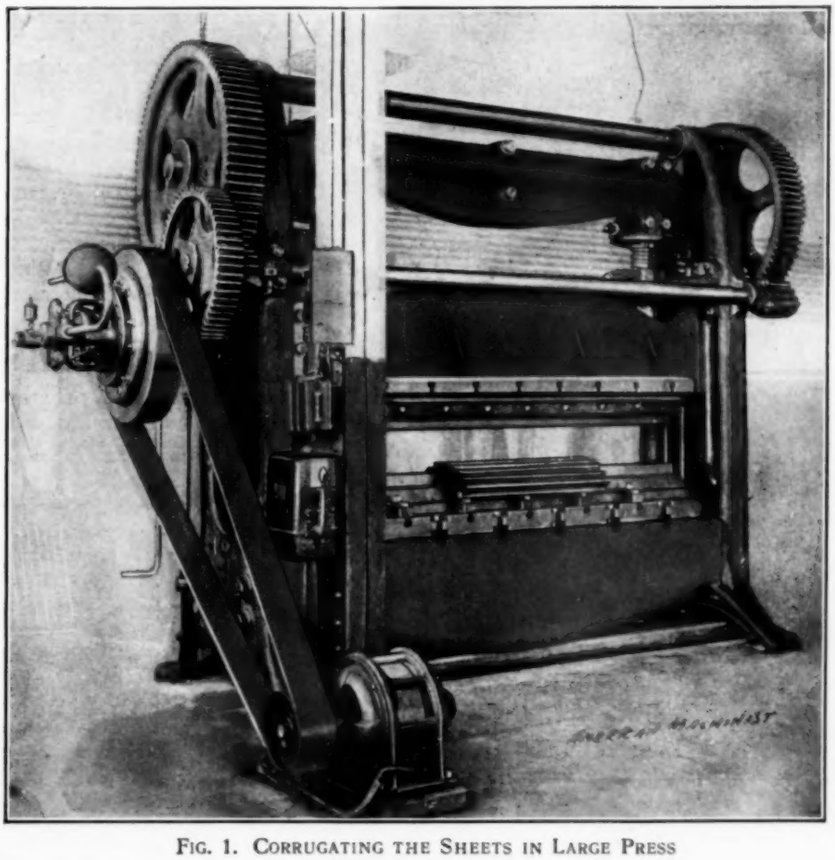


Fig. 1. Corrugating the Sheets in Large Press

These transformers are made in various shapes and styles, of which the square one at *C* is an example. To make this one four sheets are pressed to the proper shape to form the four sides and these are joined together by welding a seam at each corner.

Molding the End

For molding and casting the top and bottom on the larger size transformer, a concrete pit has been built in the foundry, as shown in Fig. 4. The corrugated sheet, shown with the clamps on in Fig. 3, is lowered into this pit, as shown at *D*.

The steel plates *E E* are then made to surround the corrugated sides at *D*, and the flasks in which to make the mold are placed on top of these plates, as shown at *F*. The pattern for the bottom of this particular transformer is shown at *G*.

As shown by the core print on the top of pattern *G*, a core is made to mold this side of the bottom. This core is made of green sand and is located in the cope, as shown at *H*. The drag part of the mold for one of the square transformer bottoms is shown at *I*. The cope *H*, with its green-sand core, is all ready to lower into position on the drag *I*, and thus complete the mold ready for pouring.

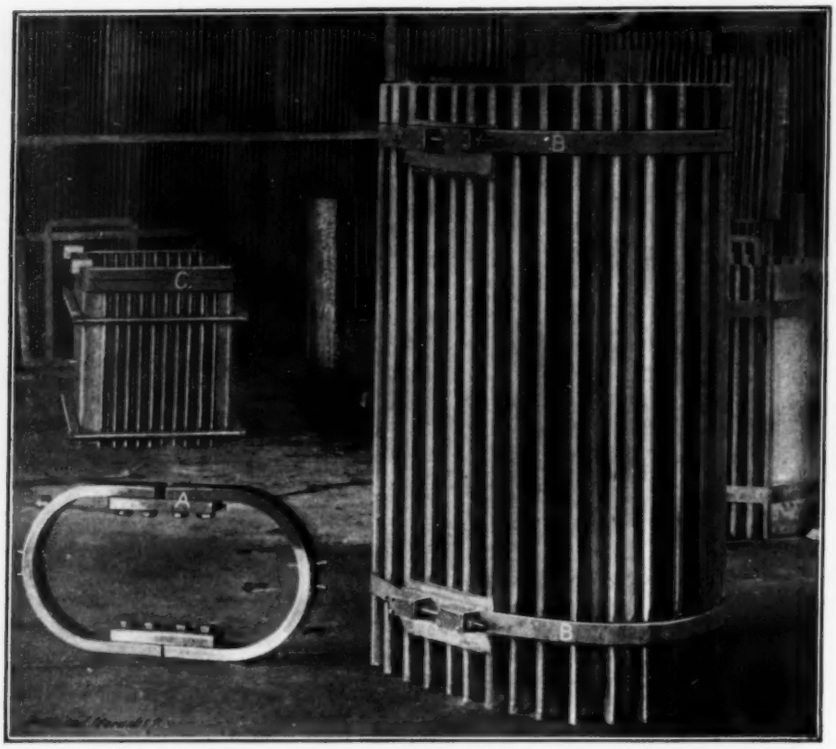


FIG. 3. TRANSFORMER SIDE CLAMPED IN POSITION READY FOR THE MOLDERS

CASTING THE BOTTOM

In the background of Fig. 5, is shown one of the oval transformer sides after it has had the top cast on. It is now ready to lower into the pit for molding and casting the bottom. In the foreground is shown the completed drag half of the mold, while between that and the corrugated side lies the cope. This cope is all ready to turn over, lower onto the drag, and be clamped to it ready for pouring.

As can be seen in the drag, the corrugated side is allowed to project up into the mold about one inch. Thus the molten iron, when it is poured into the mold, comes in contact with this sheet metal and fuses with it enough to form a watertight joint.

On some classes of work it is customary to tinplate metal, that is, to have a casting poured around it in this manner, in order to make the two metals fuse together.

COMPLETED MOLD

A completed mold, rigged up with its special clamps, pouren, etc., is shown in Fig. 6. Here the mold is all ready to pour the molten iron i-

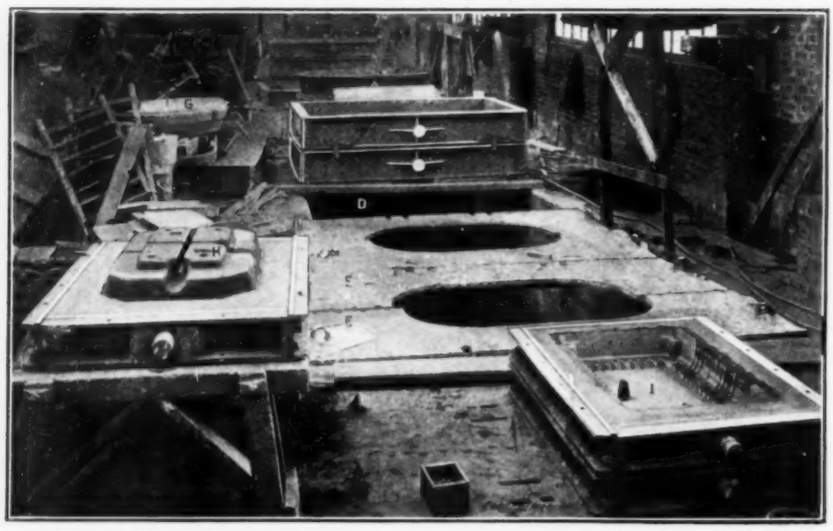


FIG. 4. CONCRETE PIT FOR MOLDING AND CASTING LARGE TRANSFORMERS

In Fig. 7 is shown some apparatus for molding some of the smaller transformers, and in Fig. 8 is shown an individual concrete pit in which they are molded.

Involute Gears*

BY LUTHER D. BURLINGAME

Speaking for a manufacturer at whose works for more than 60 years an extensive business in making gears and gear cutters has been done and which has had to deal with all phases of the gear question and meet the varying requirements of customers during those years, I can say that we are not surprised that the different members of the committee of the American Society of Mechanical Engineers are not unanimous as to any plan which would bring about a change from the present standard.

The thought seems to be uppermost in the minds of those proposing a change that a standard should be adopted having a true involute for the entire length of the tooth even if sacrifices in other directions must be made to accomplish this result.

I believe the advantage, if any, of having the entire tooth a true involute is less than we would be led to believe by those advocating a change; indeed, it is a matter yet to be demonstrated that the practical advantages of the form of tooth now in common use will not more than outweigh any theoretical advantages of a tooth wholly involute.

That the special requirements at the present time are for teeth varying both ways from the present standard would indicate that we now have a good average to meet ordinary working conditions. Our experience goes to show that for quiet running for a possible variation in center distance and to avoid back lash a small pressure angle and long tooth are of advantage, while for cases in which strength is the prime consideration even at the sacrifice of other advantages the greater pressure angle and shorter tooth have their field of usefulness.

These varying needs are illustrated in automobile practice where in some makes the cam-shaft gears are made with small pressure angle and long teeth while the driving gear is made with larger pressure angle and shorter teeth in each case for the reasons above pointed out. That strength in this latter case is secured at some sacrifice is indicated by the illustration used by Mr. Gabriel in his able discussion, where he speaks of the injurious effects of the hammer-blow action when "stub-tooth" gears are used in street-car service. This same destructive action

*Discussion of Mr. Lewis' paper on "Involute Gears," presented before the joint meeting of the Institute of Mechanical Engineers and American Association of Mechanical Engineers.

FIG. 5. TRANSFORMER MOLD READY TO CLOSE

has been noticed in stub-tooth gears used in automobile service. An engineer who has for many years made a specialty of gearing, and who is an expert on that subject and who has, in recent years, been with one of the leading automobile manufacturers of America tells me that he has repeatedly found the same destructive action spoken of by Mr. Gabriel when stub-tooth gears were used in various makes of automobiles.

Mr. Lewis, in referring to the preliminary tests made by the students of the Massachusetts Institute of Technology, says that they show that the loss by friction is varied to a greater extent by the length of addendum than by the angle of obliquity. As I understand the tests to which Mr. Lewis refers were made entirely with roller bearings, thus reducing the bearing friction to a minimum. This friction, however, was one-third greater for the 20-degree pressure angle than for the 14½-degree angle. With plain bearings where the friction on the bearings would be much greater than with roller bearings, this factor favorable to the smaller pressure angle might more than offset any advantage shown by the tests in favor of the greater pressure angle as reducing friction. As plain bearings are much more extensively used than roller bearings, the tests cannot be considered complete without securing full data, when using plain bearings.

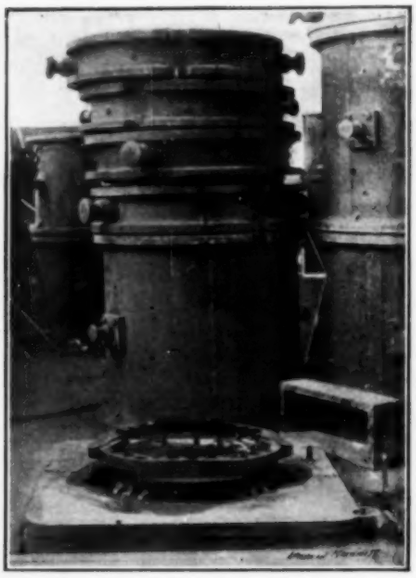


FIG. 7. RIG FOR MOLDING SMALLER TRANSFORMERS

I agree fully with Mr. Gabriel as to the need of exhaustive tests by competent engineers before any result can be accepted as authoritative. I would also take this opportunity to indorse what Mr. Gabriel has said in his discussion relating to other phases of this subject.

I do not believe that any modification of the present standard which would require more cutters in a set to insure good running gears would meet with favor among manufacturers, as it would add directly to the cost of equipment. All of the plans suggested in Mr. Lewis' paper

FIG. 6. MOLD READY TO POUR

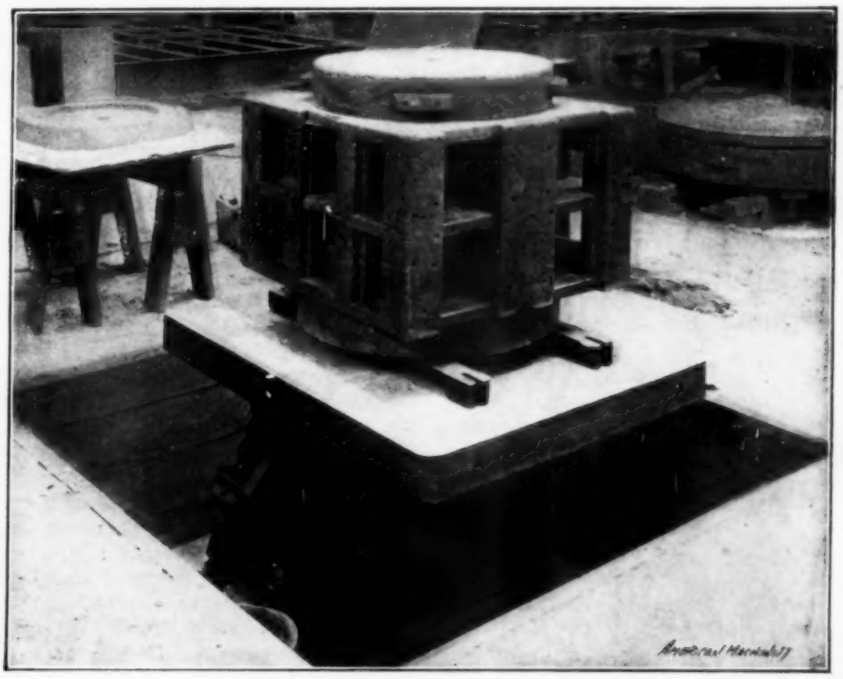


FIG. 8. CONCRETE PIT FOR MOLDING SMALLER TRANSFORMERS

are such as would require extra cutters in the set. Neither do I believe that any plan will be generally approved which will increase the amount of back lash with a given variation in center distance or with a given amount of wear.

Unless some very important advantages can be shown for some new system yet to be suggested it would seem unwise to bring about the confusion which would result from a change not fully indorsed by the manufacturing public.

The Care of Machine Tools

By William Lodge *

Practical suggestions by a machine-tool builder on the proper installation and care of machine tools.

Specific instances about leveling planers, lubricating countershafts and other cases where a little care saves dollars to the owner.

*President, Lodge & Shipley Machine Tool Company.

Let us begin with the planer. Too many people suppose that because a planer has a very deep bed, it can be set on the floor and be ready to run without leveling. This is a serious mistake. Every planer should be leveled about right lengthwise and crosswise; it should be leveled in the middle with the most extreme care. After this has been done, a pair of cast-iron or steel collars 3 inches in diameter, bored 1½ inches and ground exactly to the same size, preferably on the same mandrel, should be laid into the V's of the planer to receive the level.

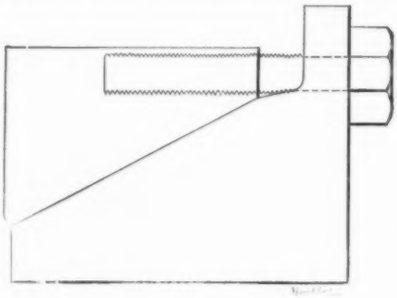
The level itself should be mounted permanently on a bar of steel planed and scraped perfectly parallel and about 3 inches in length. The two rolls should then be set 18 inches on each side of the center of the bull-wheel shaft in one of the V's of the planer, leveled with the greatest nicety and then tried in the V's on the opposite side. The next move should be to set the first roll directly over the center of the bull wheel and the other one three feet from it, either toward the front or the rear. If perfectly level, then it should be moved three feet to the other side of the center and made perfectly level. When this is done, the roll furthest away from the center should remain and the roll directly over the bull wheel should be moved three feet forward of it. Between the level and the roll, one thickness of newspaper should be placed and the outer ends lowered until it shows level. This will slightly raise the center of the bed; the level will be long enough so that when it is leveled lengthwise the rolls may be put in opposite V's and tested crosswise.

A series of feet that are adjustable, as shown in the figure, made from rough cast iron if they are a nice job will make the best device possible for the planer to rest upon and will always be ready in case there should be any discrepancy in the level to bring the planer back to an absolute level again. Four of these should be used under the four corners of the bed directly under the four corners of the housings; they should then be distributed along the length of the bed at about every six feet.

It must be remembered that the moment a planer is put into action, the action of the tool upon the work acts upon the bed and the foundation almost the same as using a peening hammer. It will also be found that in one month, no matter how good the foundation, the center will be slightly lower than the two ends and should be raised slightly so as to leave the extreme outer ends again a little lower than the middle. I have had many planer beds in my lifetime that could not be leveled; even after resting all the weight in the middle so as to lift the two ends, the bed was still slightly hollow, this because the planer upon which it was planed had not been carefully leveled and the hollow taken out.

Correcting Planer Troubles

Some time ago I was called upon by the owner of a large establishment in Boston



Adjustable Planer Foot

to see if I could discover what made its planer plane out of true, and upon examination I found that one end of the rail was higher than the other, caused by a slippage of the set screw holding the bevel pinion that operated the vertical screws from raising and lowering the cross rail. The complaint had been, after the surface and the two sides of a piece had been planed, that the two sides were not square with the surface and it can readily be seen that if the cross rail was not absolutely parallel to the top of the table this would take place.

Sufficient care is not generally used in the journal bearings of planers to apply a sufficient amount of oil with sufficient freedom, and many users of machine tools make the mistake of using a thin oil instead of the best oil obtainable having a good body. A thin oil is permissible only in the oiling of machines where it is continuously fed but never where the oiling is intermittent.

Planer beds should be examined for level at least once a month. It is a small matter and will save not only the destruction of the machine, but no end of trouble with the work that is being done on it. It should also be remembered that if a planer bed is out of true there is a tendency for all the shafts that run the gears to bind in their bearings because it is usually rather closely fitted.

Mounting Countershafts

When the countershaft is placed on the ceiling, extreme care should be taken that it is in alinement with the line shaft and level and that there is no binding to the shaft; it should be tested to run perfectly free before the belts are put on.

The same remarks would apply to the leveling of the countershaft for a lathe and they would apply equally well as to the extreme nicety of leveling the lathe crosswise. As much nicety should be used in the leveling of a lathe crosswise as should be used in the leveling of a planer lengthwise.

It is unfortunate, but true, that the mounting of the countershaft on the ceiling is very often left in incompetent hands and is the cause of no end of trouble, both to the user and to the maker.

Leveling Machine Tools

No man has a right to assume that any machine tool, or in fact any machine, even if the feet or the part that rests upon the floor can be put upon, let us say, the nicest concrete floor or the nicest wooden floor made with the greatest care, is level without special care being taken and particularly in planers; the adjusting blocks should be used in every case. Suppose, for instance, that the owner of a shop is so proud of the floor that he concludes the machine ought to rest upon it without leveling and installs it in this way; with a level tried crosswise it may show out but a trifle, and yet this trifle would indicate that the weight is resting extremely hard on points cat-a-cornered to each other; and what appears an extreme trifle on the surface, when placed under the legs or the points upon which the machine is resting, will show to be anywhere from 1/16 to ⅛ inch; I have at least seen cases like that.

Take, for instance, the case of a lathe not being properly leveled crosswise; immediately the spindle will bind in the

bearings because a lathe spindle must be fitted exceedingly close in order to carry out the principle in the machine itself when performing the work it was made for; a very little discrepancy in the leveling will cause trouble at that point; it will cause more trouble by having taken the carriage from its proper bearings, and this has frequently been the cause of what is known as chatter.

Importance of Lubrication

In these days when good machinists are so scarce, inexperienced men are frequently called upon to run very expensive tools and a lack of knowledge of the great importance of proper lubrication will destroy a good machine in a very short time. I call to mind at one time one of the nicest pieces of fitting for a worm and worm-wheel engagement with a pocket provided to receive and carry the oil so that the worm could touch it; I saw where the operator of that machine carelessly let the oil get too low so that the worm did not touch it and I saw that worm and worm wheel both destroyed in one hour.

I call to mind another case where a man was doing something up near the ceiling and brushed off some gritty dirt that fell onto the ways of a planer, destroying the ways of that planer in one hour.

It is impossible to express too strongly the great importance of having not only all revolving parts but all reciprocating parts provided with oiling devices that will not only serve the purpose but if possible that will remind the operator that they require to be fed.

Keeping Machines Clean

I want to say a few words relative to the keeping of a machine clean. Too little attention seems to be given to this point. It is lamentable that tools or machines that have cost thousands of dollars should receive less care so far as cleanliness is concerned than is bestowed upon the floor upon which they operate. Why not have a sign or a notice posted that each machine must be kept scrupulously clean and well oiled?

While I am on the subject, I want to call attention also to the line shaft. I was told recently by an expert in line shafting that he frequently found cases where a line shaft was out of line in a length of 50 feet as much as two inches; in some cases out of level as much as one inch. I was also told by an engineer recently that he had found one case where 80 per cent. of the entire power of the engine was taken in friction.

Surely someone's attention should be called to such matters by your excellent journal.

Some Effects of Carelessness

By Entropy

A few cases where carelessness costs money and where the helper is more reliable than the man higher up. How lack of concentration prevents us from doing our best work and a suggestion that we all need more accurate knowledge instead of "education."

The most common of daily occurrences is delay caused by someone's carelessness. A bid may be all ready to submit except that someone forgot to reply to our letter asking for prices. A contract may be held up a day because someone forgot to order a car shunted off on our side track or someone else ordered spruce timber instead of hard pine, or a machine cannot be shipped because the only skids on hand are two feet short, or some one of a thousand and one perplexities may have arisen. The worst of it is that these little lapses of mind that mean so much in the aggregate can often be laid to educated men rather than to the more strictly laboring class. Tell a helper to ring a certain bell at 4:30 and you are pretty likely to hear it at 4:30. Tell your best accountant, your most accurate man, and if you hear it before 5 you are lucky. Your coachman (beg pardon, chauffeur) will meet you at the train and your best friend, who has been looking forward to your visit for a month, will be ten minutes late!

These are all well known and well worn statements, but how are we to account for them and how cure the disease?

The Mental Card Index

A man's brain may be likened to a card index. If well arranged it is easy to find any card at short notice. If ill managed it is difficult to find it and vastly more difficult as the number of cards increase.

Most of our mental card indexes are far from well arranged. The man who has stored away in his head only a few ideas can run over his stock readily and a new one is easily found. The man with a great stock of undigested ideas may know many things, but when he comes to look over his stock to find one certain thing that he carefully laid away in the morning, it is so mixed up with so many other things that it is only by accident that he discovers it at all.

Most learning, especially of the college variety, is so rapidly acquired and so little understood that it appears in our minds much as a card catalog would after the rats had eaten their way through it. Here and there an idea is left, standing alone and possibly of no earthly use to man or beast, and next to it a card full of vital facts so eaten away as to be entirely illegible.

What can a man do to rectify this state of affairs? Little enough, because by the time he is old enough to realize the chaos which reigns in his cranium the mischief has been done. He can begin over again, clear out a few of the nearest pigeon holes and refuse to store away one single fact that he does not understand. When he is given an order he must think of the order, not of the number of buttons in the back of his wife's new dress. He must understand the order or he will not remember it. If he is told to blow the whistle at 5:50 and he understands it he will remember to blow it at 5:50, while if he is wondering whether it is time to bring out his straw hat he may blow it at 3:30 tomorrow afternoon and he may never blow it at all.

The whole question is one of concentration on the business in hand.

How about the man at the head who is daily suffering from these lapses of memory? He can place responsibility by giving written orders, but written orders are forgotten quite as often as spoken. The written order breeds looseness because one is so apt to give an oral order and say that he will confirm it in writing when he gets back in the office.

There is apparently no absolute remedy. Relief is had by hiring a few skilled men who do remember and so systematizing things that cheap labor, that does habitually remember, does the actual work.

Some relief is found in subdivision of forces so that it is one man's duty to catch as many other men napping as possible; the final solution seems only possible in the distant future and then only if we are willing to reform this modern craze for filling children's heads with totally unusable learning that neither they nor their teachers understand. We are suffering today like a man with a large vocabulary of words whose meaning he does not know. He makes misstatements innocently and if he uses any but the common words he is misunderstood even if he uses them correctly. What is needed is less education and more accurate knowledge of a few things.

Tools from the Autocar Shop

Editorial Correspondence

A few of the interesting fixtures and tools used in forming the steering knuckle. The method and the tools used to machine the pump bracket of the Autocar.

The accompanying illustrations show the fixtures and tools used for two interesting operations in the making of the steering knuckle and pump bracket for the automobiles manufactured by the Autocar Company, of Ardmore, Penn. In Fig. 1 the steering knuckle is shown in various stages of completion, together with the turning tools used in its making. In this figure *A* shows the rough drop forging and *B* the same piece after being rough-turned by the serrated shaving tool there shown. At *C* the next step has been taken, and the turning finished with the shaving tool shown alongside of the piece. At *D* the threads have been cut on the end by means of the chaser just to the right of the piece.

In Fig. 2 the method of mounting and using these tools is shown, this being a view looking down upon an engine lathe modified for this particular job. It will be seen that both the roughing and finishing shaving tools are held in special jaws mounted upon a plate, traveling upon the cross slide. By operating the screw of the cross feed, the serrated roughing tool is first brought up to the work and then by reversing the cross-feed screw, the finish shaving tool is fed in to complete the operation. It will be noticed that toward the top of the illustration, a little to the left, there is an index pointer traveling over a scale which is used to determine the depth of cut.

Machining of the pump bracket is shown in Fig. 3, this again being done in a modified engine lathe, and Fig. 4 shows the different tools used. As seen in Fig. 3, the bracket is held in a special fixture, and guides for the different boring tools are located at each end of the fixture, outside of the work, and also in the middle, between the two bored portions of the casting.

In Fig. 4, beginning at the right, No. 2 is the first drilling tool; No. 3, the rough boring, this cutting in three places at once, and No. 4, the finish boring tool of similar form. No. 5 is for facing the ends of the bored portions of the casting. Nos. 6 and 7 are reamers for the two different sized holes, and No. 8, the tap for cutting the threads for the stuffing box at the bottom of the bracket. On most of these tools will be seen a sleeve which acts to guide the tool in the fixture, these sleeves forming bushings which lock in the fixture by the familiar bayonet-lock arrangement.

These show a keen appreciation of the advantages of having tools readily removable so that changes can be made quickly. Many overlook the time lost in this way, apparently forgetting that a half minute lost at every change counts up into hours in the course of a week. The convenience to the men handling the tools also adds to the output.

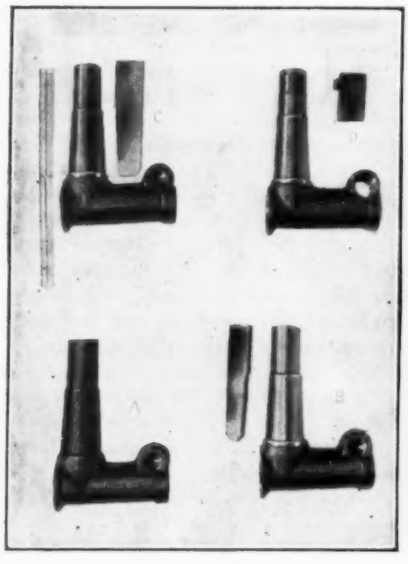


FIG. 1. STEERING KNUCKLE SHAVING TOOLS

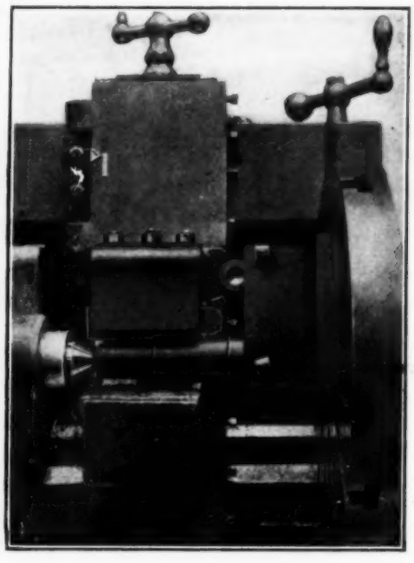


FIG. 2. WORK AND TOOLS IN THE LATHE

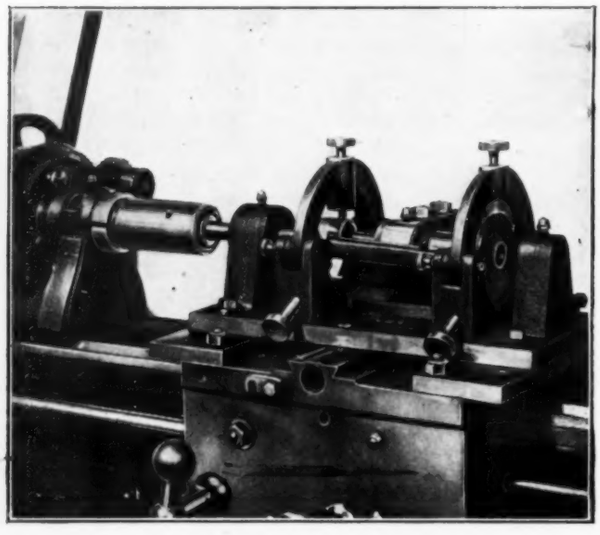


FIG. 3. MACHINING THE PUMP BRACKET

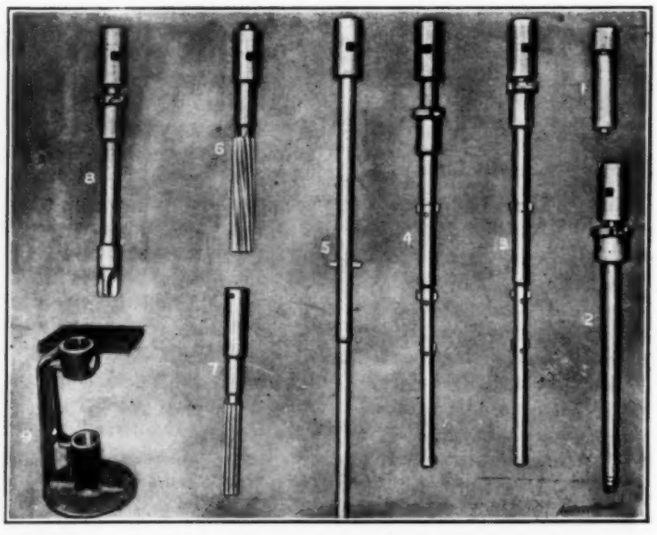


FIG. 4. THE TOOLS FOR THE PUMP BRACKET

Notes from Belgian Shops

Editorial Correspondence

The Brussels Exposition just before the disastrous fire.

Visits to four of the leading shops and the University of Liege.

A unique memorial to four workmen who helped to start a famous business.

A visitor to Brussels at this particular time will naturally turn toward the exposition,* and find there much of interest and profit. There are three machinery centers: the machinery building proper, the French section and the German building. Many of the exhibits in all three places are worthy of detailed study, but can only be mentioned here.

In the Machinery Hall are the exhibits of American manufacturers by their European agents, and of Belgian, English, Swiss and Italian builders.

The Belgians showed many heavy machine tools, particularly for railroad shops.

The Swiss firms, on the other hand, tended toward lighter and automatic machinery, one exhibit being two sizes of an 8-spindle, vertical, automatic turret machine.

Some of the real novelties in design were in the French booths: a drop hammer with structural-steel shears, a combined toggle and hydraulic press, presses with automatic, self-registering, staggered feed and power presses with pressure-relieving attachments.

Again some of the best sheet-metal and tube work can be found among the work of the French shops. Seamless copper fireboxes, weighing several tons, for locomotives; seamless copper tubes over three feet in diameter; extended tubes of many sizes and shapes; seamless steel tanks with nozzles and manhole frames welded or drawn into form without using a single rivet; complicated forgings and steel castings of every description—these were a few of the interesting pieces shown, indicating the extent to which French engineers have carried the arts of drawing, welding, extruding and forging metals.

Italian firms showed lighter machine tools more particularly adapted for automobile parts and light machinery building, although one firm had several heavy hydraulic presses, including one for briquetting chips.

Many English firms were well represented, gear-cutting machinery being particularly noticeable.

The machinery section of the German building needs especial mention; large booths, extensive lines and working exhibits testified to the care with which the various products were shown with a thought to the extension of trade. Here could be found the largest machine tools in the exhibition and also some of the smallest. Grinding machinery received a great deal of attention; one firm showed among other machines an automatic hob grinder, an automobile engine-cylinder grinder, a Diesel motor sleeve grinder and a locomotive driving-axle grinder, intended for repair work. An oddity as regards a material of construction was seen in centrifugal and plunger pumps made from vitrified clay, for use in handling acids.

There were a few exhibits by Russian manufacturers, one in particular of a leather belt made of strips about 5/8 inch wide ingeniously sewed together, making a heavy belt with the edges of the strips in contact with the pulleys.

In the transmission field a Belgian firm had a working exhibit of paper-rimmed pulleys on both iron and wood centers, giving a construction that had the appearance of great durability.

*Written before the fire.—Ed.

Usines Pipe—Brussels

This automobile factory has an output of some 30 cars per month, and builds both pleasure cars and omnibuses. The machine-tool outfit is largely American and German. German hobbing machines are quite popular.

The raw material, aluminum castings and hand and drop forgings come largely from Germany. Special tools are used to quite an extent, for drilling and boring the crank case, boring the cylinders, etc. Surfacing operations are done on the planer, using shoes to gang up a large number of pieces.

A feature of this shop, and one that holds for all the shops visited in Belgium, is a one-story construction for the buildings with light from the roof. Multi-story shops were not seen. In all cases the head room is greater than one would find in the United States for a shop doing small work.

Heating is by steam with large flanged coils brought into the centers of the rooms and not confined to the side walls.

A most pleasing feature of many shops is the beautification of the grounds and buildings by flowers and trees and vines. In a climate where vegetation is apparently luxuriant it is probably an easy matter to obtain results of this kind that would be impossible in many places because of unfavorable natural conditions.

Ateliers Demoor—Brussels

This firm builds machine tools exclusively with a speciality of lathes. For American readers it is perhaps best characterized by saying that if the equipment was in a factory building of the type common in the United States, a casual observer would think that he was in an American shop.

The one-shop plan of organization has been followed out, and one sees such well defined departments as planer, gear cutting, turret lathe, tool making, tool storage, rough stores, finished stores, assembling, etc.

Lathes are built in lots of 20, and the design is on the unit plan, with the headstock, tailstock, carriage, apron and geared feed box as assembled units that are carried in stock. If a lathe of unusual length is ordered it is only necessary to make the bed; the other parts can be taken from the stock room.

The regular type of lathe as built here is fitted with belt feed, although a geared feed box can be attached if desired. M. Demoor believes that a customer should not be asked to pay for an attachment that he does not need for the general run of his work, and, therefore, treats his geared feed box as a special attachment.

In Belgium the competition in machine tools is keen: on the one side from America, on the other from Germany.

Société Anonyme Bollinckx—Brussels

At this well known plant 4000 men are employed on steam engines and gas engines. The equipment is largely American, although many tools have been built at the works. The entrance is through a flower-filled courtyard, to one-story buildings with brick walls and skylighted roofs.

Work is done on an interchangeable basis with master templets for laying out. In the main the operations are similar to American steam-engine building practice.

Well defined tool-storage rooms are in use with a check system. The time of the workman is registered by calculagraphs, and much of the work is done on a modification of the premium system of paying for labor.

An interesting point in technical education was shown by the presence of volunteers. These are young men who have finished their technical education at some university and enter the shop without pay for one year and spend their time in observing the work that is done. However, they do not do any machine work themselves.

University of Liège

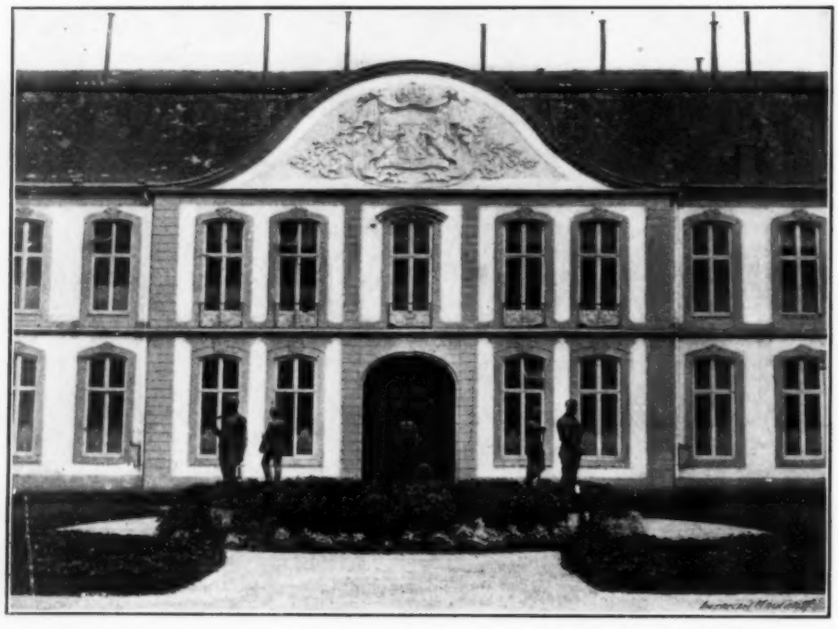
A visit to Liège would not be complete from an engineer's viewpoint without a visit to Professor Dwelshauvers-Dery, at the University of Liège, and the

steam-engine laboratories where his research work was done. To Professor Dery is given the honor of having first suggested the establishing of a steam-engine plant in a teaching institution, and although his plant was not the first of its kind it was one of the earliest. In the field of research Professor Dery's name is always associated with the disproving of the direct application in practice of the Zeuner theorem that compression in a steam-engine cylinder should be carried up to the initial pressure to obtain maximum economy.

Professor Dery, who is now professor emeritus, received me most cordially and on visiting the laboratory showed the engine with which his experiments were made and the devices used to insure the accuracy of all the observations.

château of Seraing with its lands for the sum of 45,000 francs ($9000). He also gave permission to erect shops and carry on manufacturing. This bit of history explains the structural beauty of the office buildings of the works, for they are the buildings of the old château. As you pass through the entrance gate you see before you a large courtyard, with lawns, flowers, vine-covered walls and in the center a large fountain with four portrait statues in bronze. These are of four workmen who came over from England with John Cockerill when he founded his business nearly a century ago. Their erection is a pleasing manner in which to commemorate years of faithful service.

These statues were cast in their own foundry and one of the men, the puddler, is still alive.



FOUNTAIN AND STATUES OF FOUR WORKMEN AT THE COCKERILL WORKS

Prof. Armand Duschene, the present professor of steam engineering, has done a great deal of experimental work to determine the temperature of the steam and cylinder walls for various positions of piston travel. Associate Professor Hanocq has devised apparatus to determine the pressures in centrifugal pumps at various places in the volute, and also to determine leakage around the impeller when the impeller is running and when it is still. However, his experiments are not complete.

SOCIÉTÉ JOHN COCKERILL

Associated in one's mind with Liège are Seraing and the great works founded by John Cockerill. This immense plant employs 10,000 men in its varied industries and is situated amid most pleasing surroundings.

In 1817 the king of Holland transferred to an Englishman, John Cockerill, the

Here is the birthplace of gas engines using blast-furnace gas as fuel. Some of the first engines built are still running.

In machinery building the principal work today is gas engines, blowing engines, locomotives and ordinance—if ordinance can be called machinery.

The works are carefully laid out and do not give an appearance of having just grown but as having expanded in carrying out a definite plan.

The large machine tools are mostly German and Belgian, some of the smaller of American manufacture, and a sprinkling of tools made in the works. Among the latter was seen a machine for grinding cams to a master former by rotating the cams slowly past a swinging carriage carrying a roll in contact with the master cam and an emery wheel acting on the cams to be ground.

An interesting feature of the overhead works is the use of channel beams to support the countershafts, thus entirely eliminating wood. This harness work is bolted or clamped to a system of steel girders carried by the interior columns of the building and independent of the roof and its framing.

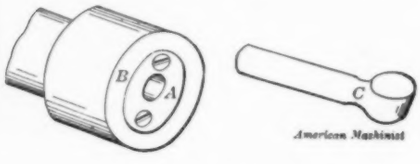
As a feature of gas-engine cylinder design, this firm passes a plurality of heavy bolts through the water space of the cylinder jacket, and thus places the cylinder barrel under initial compression between the heads; at the same time it is wedged on the sides between shoulders on the housing. By this construction they can keep the wall of the cylinder thin and do not resort to any linings. The success of the design is attested to by the fact that they have not had a cylinder break for three years.

In regard to piston-rod breakage they have cured this difficulty by a careful selection of steel. Here they have, perhaps, a peculiar advantage, for they make both bessemer and electric-furnace steel.

Finishing by Rolling or Burnishing

BY I. B. RICH

Many railroad shops finish crank pins and similar bearings by using a hardened-steel roller which compresses the surface and seems to give very good results in practice. A somewhat similar method is sometimes used in finishing small holes, by forcing a solid plug through the hole and compressing the



BURNISHING DIE

metal on its surface so as to produce the correct size as well as leaving a good finish.

This brings to mind a job of brass work that was handled in a somewhat similar way about 20 years ago. The work itself is shown at *C*, and consists of a brass stem about 2½ inches long and perhaps ⅝ inch in diameter on the finished part. It was necessary for these to be made very close to size and as the hollow mill did not give entirely satisfactory results, we made a burnishing die for the finishing operation.

This die was simply a piece of hardened steel bored and ground to the correct diameter as at *A*, and held in the holder *B* the same as the screw-cutting die. By occasionally lubricating this with a drop of oil, it produced a remarkably good surface and the pieces could be relied upon to be more nearly to size than when the hollow mill was used.

Laying Off Shoes and Wedges

By M. H. Westbrook

Clear and concise directions for laying off shoes and wedges in the railroad shop or roundhouse.

Illustrations which show just how every step is taken so as to avoid making any false moves.

A method that has worked successfully in many cases.

See that all pedestal braces are properly fitted and securely bolted to their respective positions and that all frame jaws are filed perfectly level.

Run a line along each side of the engine through the center of the cylinders to the farthest point away on the engine frame.

Then put a straight-edge across the frame jaws and by the use of a large T-square see if they are square with the line. If found to be out, say, ⅛ inch, divide up the difference, allowing 1/16 inch long on one side and short 1/16 inch on the other side. This is called equalizing.

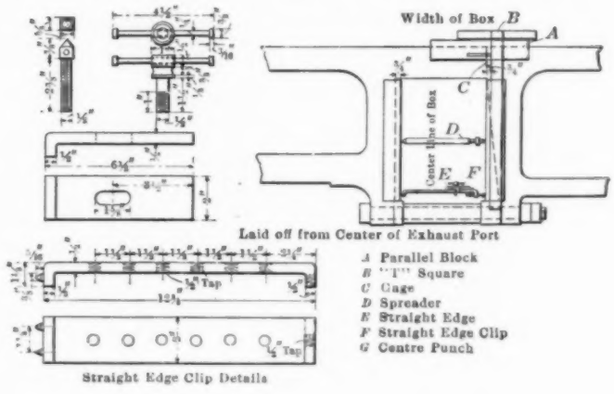


FIG. 1 TOOLS FOR LAYING OFF SHOES AND WEDGES

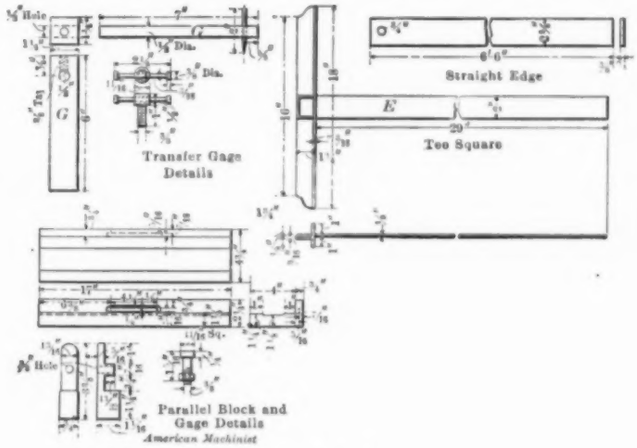


FIG. 2

Then lightly pop mark these two points and also make two light pop marks ¾ inch away and wider from these two and the same distance from the top of the frame.

Then using the spreaders *D* shown in Fig. 1, put the shoes and wedges in place, leaving about ⅜ inch for draw on wedge. Put the block *A* on the top of the frame, which should have first been carefully cleaned off and any lumps filed away.

Now place the T-square on the parallel block *A* and set the sliding ¾-inch gage *C* to correspond exactly with the small pop mark already made in the frame ¾ inch wider than the driving box.

Bring the square up to this gage block and scribe a line down the side of the shoe and repeat the operation on the other shoe. The straight-edge *E* with the clamps *F*, as plainly shown in the halftone, is then brought into service to transfer the pop marks to the other side of the shoes and wedges.

Before shifting the straight-edge, place the center-punch guide *G* in position and set the punch to correspond to the line just scribed, and tap it lightly, making a small pop mark where needed, as shown in halftone.

Reverse the center-punch guide and pop mark the inside of the shoe, then mark the other shoe likewise. The top of the shoes and wedges must also have a light pop mark on the line, and in order to insure that the planer hand makes no mistake, setting the shoes and wedges up that may accidentally have been made, it that may accidentally have been made. It has been found well to take a steel figure "O" and stamp it, so the pop marks come about in the center of it. The machine operator thus always knows just where to look for his setting-up marks.

Some shops allow the use of liners on shoes, should there not be sufficient metal to permit of cleaning them up on the planer. Should this be done, see that the liners are securely riveted in place and all unevenness taken off before laying off the shoes. Personally, I am not in

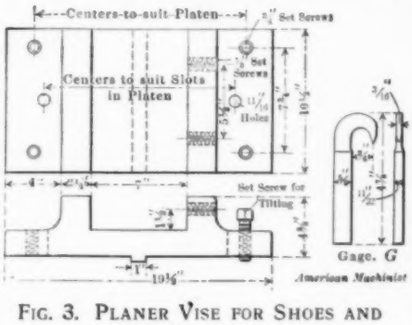


FIG. 3. PLANER VISE FOR SHOES AND WEDGES

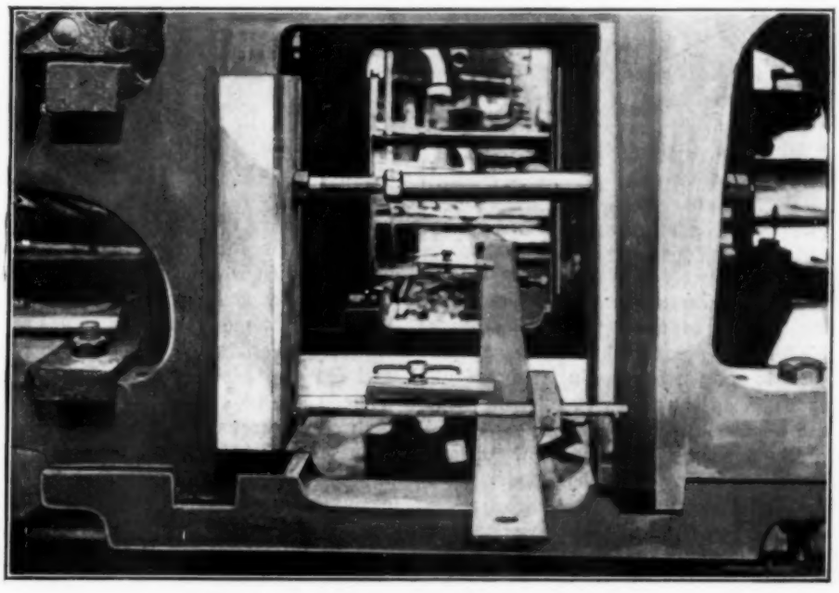


FIG. 4. THE LAYING-OUT TOOLS IN PLACE

favor of lining shoes except in cases of necessity.

The wedges will now be laid off with the trams set to 1½ inches wider than the driving boxes to be used. It is assumed that all the boxes have been planed the same size, otherwise slightly more care must be taken with the measurements.

The shoes and wedges in the other jaws will be laid off by the use of standard trams, usually kept in the tool room, the exact length for each class of engine.

The shoes are planed in the special vise shown in Fig. 3, which can be slightly tilted by set screws in the base to suit pop marks; the planer gage shown is used to plane them to, and great care must be taken to see that this gage corresponds exactly to the marks given to set them by. Fig. 4 shows how the tools are used.

The man who lays off the shoes is also provided with a duplicate of this gage, thereby insuring a proper check on the planing.

Measuring Aeroplane Altitudes

By Augustus Post *

To accurately determine the altitude reached when Walter R. Brookins broke the World's Record for hight with an aeroplane, at Atlantic City, a base line 2½ miles in length was chosen.

An engineer's transit was located at each end of this base line with its telescope clamped in the vertical plane passing through the line, and by sighting upon the aeroplane as it passed above, the vertical angles at each end of this line were determined.

Knowing the base and two angles of the triangle thus formed, the altitude was easily and accurately calculated.

Recording barometer used as a check.

*Mr. Post is official recorder for the National Council of the Aëro Club of America.

To obtain the altitude of Mr. Brookins' (Wright) aëroplane at Atlantic City, for the National Council of the Aëro Club of America the first thing that was done was to lay off a base line of sufficient length that the angles observed through the surveyors' transits would not be too great when the aviator crossed this line at his highest point.

Such a base line was laid out running from the outer end of the Atlantic City steel pier to a point on the board walk, near Tallahassee avenue, about two miles and a half distant. A boat was anchored midway along this line so that the aviator could tell the point at which to cross the base line.

The exact length of this base, which was obtained by triangulation and the use of the measurements of the Atlantic City monument system, was found to be 13,394.29 feet, which is undoubtedly correct within a narrow margin.

Two surveyor's transits were set up, one at each end of this line as a base; each telescope was pointed toward the other station and clamped in that vertical plane, although movable in altitude in that plane. The question might be asked as to why it was necessary to have the telescopes clamped in the line between the two stations, thereby requiring the aviator to cross this line when at his highest point, if his highest altitude was to be recorded, in view of the fact that an engineer's transit will measure angles in azimuth as well as in altitude. John W. Hackney, of the firm of Ashmead & Hackney, civil engineers, of Atlantic City, under whose direction the engineering problems were worked out, has ably answered this question in his official report as follows:

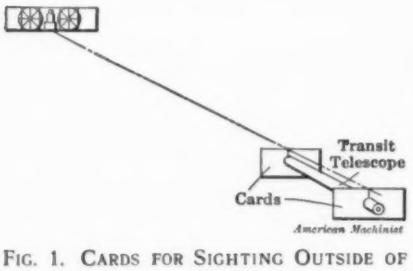


FIG. 1. CARDS FOR SIGHTING OUTSIDE OF TELESCOPE FIELD

"This might possibly be the best method, i.e., to move the telescopes in azimuth also, if the aviator, having reached his highest point, could stop his aëroplane for a moment and then signal both observers to note his position. But this cannot be done. He himself might not know just when he was at his greatest elevation, and it is quite certain that he could not momentarily stop his machine; but assuming that he did know and did give a signal, we must still assume, since he cannot remain still, that both observers have the aëroplane within the telescopic field of view at the moment the signal is given. This means that each telescope must be kept continuously upon the aëroplane by moving it steadily and continuously both in altitude and azimuth. This motion, unless the object is very far off, may be too rapid for slow-motion tangent screws, and in any event the range of continuous motion by the tangent screws is quite limited. An actual attempt will quickly convince the observer that such a method is impracticable.

"The same reasoning will show that the firing of a pistol by some observer as a signal when the highest altitude has been reached, and when observations are to be taken, or the making of simultaneous observations at stated moments by reference to synchronized watches, is impracticable, since both methods presume that the object is within the field of view at the precise moment the signal, or order to observe, is given.

"The establishment of a vertical plane passing through the instrument stations simplifies the problem, if the aviator passes through it approximately at right angles thereto, since the observations which must be made by both observers while the object is in the field of view must be practically simultaneous, which is, of course, a necessary condition.

"The work of the observer is reduced to the maintenance of his instrument in proper level, and the single observation of altitude. This, so far as the pointing is concerned, is quite a problem, since the telescopic field is small, and unless the observer has his telescope at the correct altitude he may, and probably will,

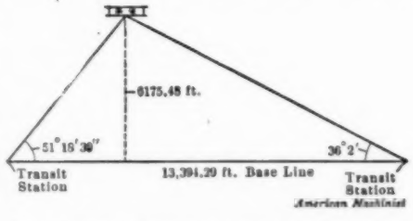


FIG. 2. THE TRIANGULATION OF ALTITUDE

miss the transit of the object altogether. To avoid this, range sights were attached to the telescope of each instrument. These were rectangular strips of stiff cardboard 3½x8 inches, two for each instrument.

"In the center of each card was cut out a circular hole; one card was slipped over the object end of the telescope, removing the sunshade for this purpose and then replacing it, and the other was fitted to the eye end. These cards were leveled by ranging with the horizon. A

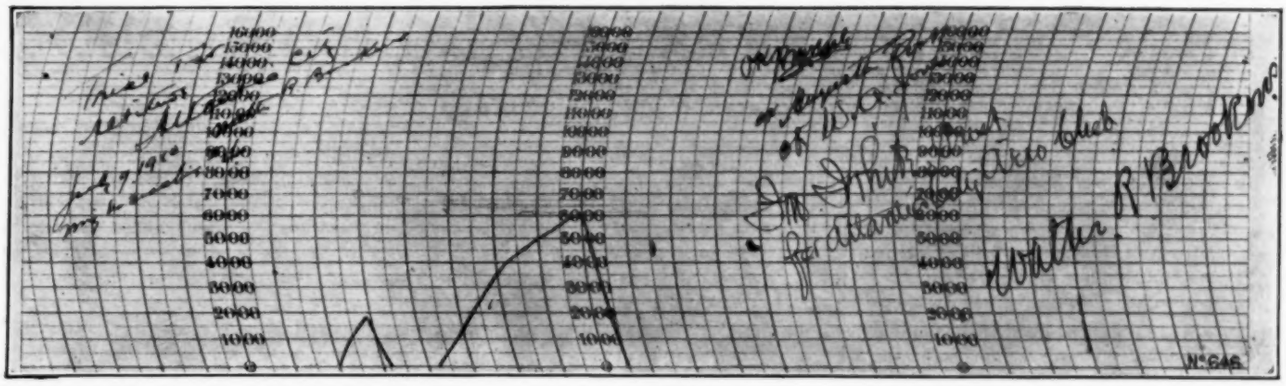


FIG. 3. FAC-SIMILE OF RECORD OF ALTITUDE REACHED IN AEROPLANE FLIGHT BY WALTER R. BROOKINS, ESTABLISHING THE WORLD'S RECORD. CHART TRACED BY RECORDING BAROMETER

black line was ruled on each card midway between the ends to act as a sight for the telescope. A plane resting upon the top edges of the two cards would be parallel with the horizontal axis of the telescope.

"The telescope was moved in altitude so that the upper edges of the two strips of cardboard were in range of the aëroplane. This range was closely maintained by moving the telescope up and down with the left hand, while the right hand held the clamping screw. The eye was kept likewise in range with the aëroplane and the vertical black line on the card nearest the eye. Just before this line

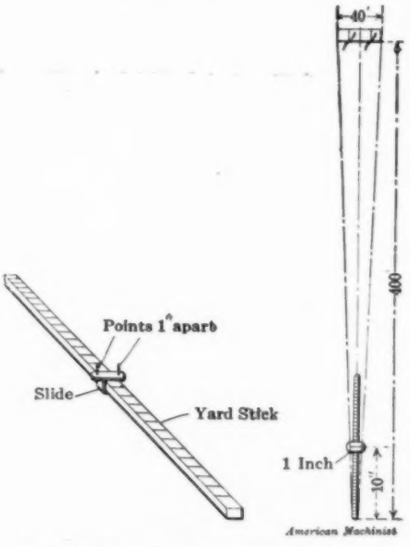


FIG. 4. YARDSTICK METHOD USED BY WRIGHT BROTHERS

and the line on the object end of the telescope came into range, the telescope was clamped, the right hand was quickly transferred to the tangent screw and the eye to the telescope.

"If the aëroplane crosses the line at a reasonable distance from the observer, and in a direction at right angles to the line, there is no difficulty in getting an accurate sight; but if he is too near, or the angle is too acute, the observer may miss the transit altogether, since the altitude of the aëroplane is changing with great rapidity."

The angles read at the moment of crossing the base line on the particular occasion when Mr. Brookins was at his highest point were 51 degrees 18 minutes 30 seconds at the steel-pier station and 36 degrees 2 minutes at the other station. These angles being known, with a known base it was possible to figure out the altitude, which was 6175.48 feet above mean sea level.

In this case the aëroplane itself was fitted with a Richard recording barometer, which registered automatically a hight of 6200 feet, as seen by the chart which is reproduced. This is a very good check on the surveyors' calculation, and shows how the ordinary balloon practice may be of value to the aëroplanist.

The Wrights themselves use a very simple and rough, but remarkably accurate, method of obtaining altitude. A man lies on the ground, on his back, and sights along a yard stick held directly above his eye. There is a slide on this stick, with two points just one inch apart. When the aëroplane is directly over the observer, this slide is moved along the yard stick until the points are in line with each end of the aëroplane, which is known to be 40 ft. wide.

If at this time the points on the slide are 10 inches from the observer's eye we have an equation which would be: 1 inch is to 10 inches as 40 feet is to x feet, or $x = 400$ feet.

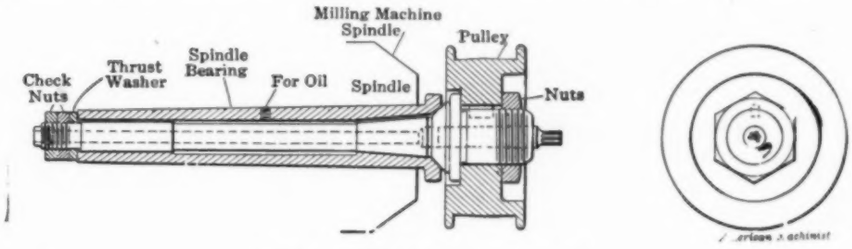
Altitude measurements will be of the utmost importance in finding the range of an aëroplane in time of war and to catch sight of a moving object is very difficult with instruments designed for fixed objects. Great angles may be read by means of solar transits, or mountain theodolites, and instruments fitted with prismatic eyepieces, but these are not easily obtainable.

One old sailor even calculated that Brookins was at an altitude of about 6200 feet, by means of his antique quadrant, and said he could come closer if he knew just how wide the aëroplane was.

High Speed Milling Attachment

BY E. N. TRACY

Having a large number of pieces to mill and using a small end mill which had to run at a higher speed than we could get from the milling machine itself, we rigged up a high-speed milling attachment as shown in the illustration.



HIGH-SPEED MILLING ATTACHMENT

The spindle, which is of tool steel, hardened and ground, is fitted with a No. 3 Jarno taper for the end mill and has a hole through it for knocking out the mill. The spindle runs in its bearing, which in turn is driven into the milling-machine spindle, which does not revolve. A small pulley is keyed to the spindle and is driven by a large pulley fitted to the countershaft of the miller.

An auxiliary spindle of this kind is often more economical than running the main spindle at an excessive speed even where it can be done. The cost of wearing the main spindle will soon pay for an auixiliary spindle of this kind if much work is to be done.

Some Small Tools in a Railroad Shop

Editorial Correspondence

Some of the special tools used in the Beech Grove shops of the Big Four Railroad.

Tools and fixtures for recessing, handling crown brasses, driving staybolts, centering piston rings, straightening piston rods, ball bearing reamers and a flue sheet cutter.

The question of special tools has received careful attention at the Beech Grove shops of the Big Four railroad, some of them being illustrated herewith. Fig. 1 shows a very simple form of recessing tool which contains all necessary dimension and that can be very easily made by anyone who desires.

The tool itself is in the form of a lever with a hooked end *A*, which is pivoted in the body of the tool which is of the correct size to fit the hole to be recessed, as this supports the work while it is being operated on. After the tool has been pushed into the hole to the required depth so that the end of the bottom of the nut *B* is turned by hand and forces down the back end of the cutting tool, at the same time forcing the cutting point into the work.

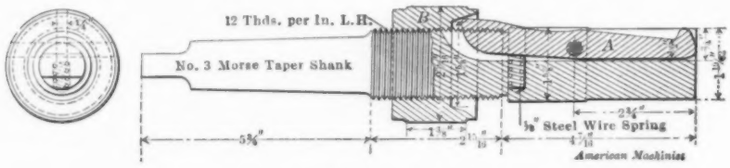


FIG. 1. RECESSING TOOL

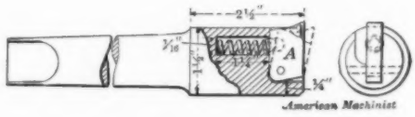


FIG. 2. RECESSING TOOL

Fig. 2 shows another recessing tool which is very easily made and seems to work well. The cutting blade *A* is normally forced out into the position shown by the dotted line, by the action of the spring, which has a quarter-inch steel ball interposed between it and the blade itself to provide a good bearing. When the projecting cutter strikes the bottom of the hole it is forced back and the point swings out to a larger radius so that when it reaches the position shown by the solid line, it has made quite an undercut at the bottom of the hole. The edge of the cutting blade, which strikes the bottom is rounded to prevent cutting and to make the action easy.

Fig. 3 shows the clamp used for turning crown brasses for locomotive driving boxes. These are simply soft-steel clamps, having the ends serrated or notched as shown and afterward case-hardened to prevent the teeth getting dull, and containing centers on which to swing them in the lathe. They are then clamped onto the crown brass, as shown, so that it can easily be turned up in any lathe of sufficient swing.

A somewhat unusual form of hollow milling and a hollow milling cutter and threading die is shown in Fig. 4. They consist primarily of the holder *A* having a bell-mouthed opening, which receives the hollow mill or die, as the case may be. The band around the outer end of the cutting tool is provided with adjusting screws as shown, by which any desired variation in size, within the limits of the tools, may be easily obtained. This form of tool was designed particularly for making plugs for grease cups for locomotive use.

STAYBOLT CLUTCH

Fig. 5 shows a convenient form of staybolt clutch or driver, which is used for screwing staybolts into place. It consists of the holder or body *A*, the front plate *B* and the eccentric ring *C*, with

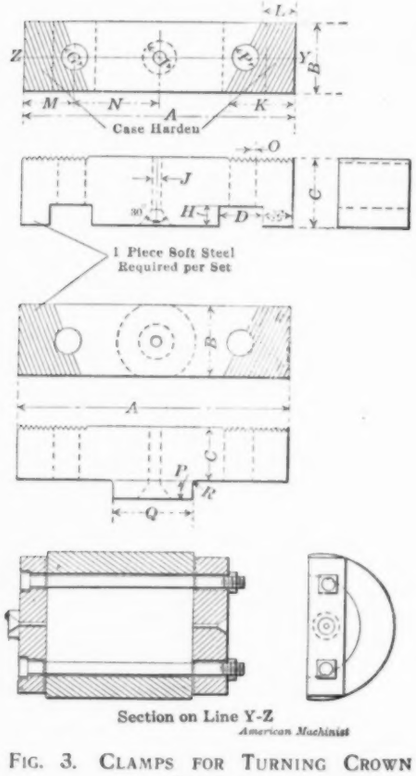


FIG. 3. CLAMPS FOR TURNING CROWN BRASSES

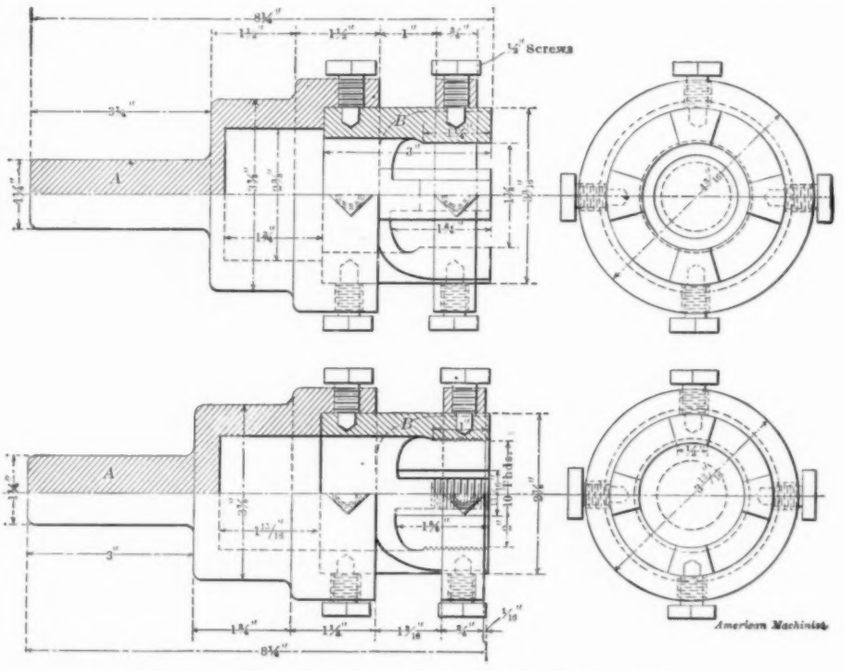


FIG. 4. SPECIAL CUTTER AND DIE FOR GREASE-CUP PLUGS

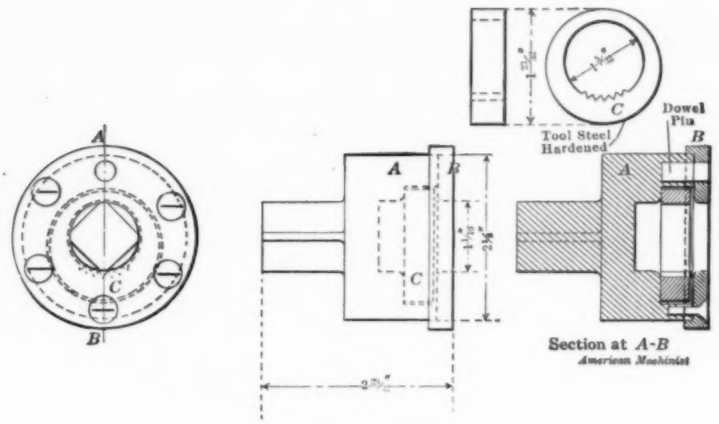


FIG. 5. STAYBOLT CLUTCH

the teeth cut on a portion of its interior. As the recess into which the clutch fits is eccentric with the body *A*, the combination of the eccentricity of both this recess and the clutch *C* makes it possible to secure a wide range of adjustment, so that the teeth on the inside of the clutch ring can secure a firm grip on almost any size staybolt which comes along.

Fig. 6 shows another form of staybolt clutch used for driving threaded staybolts. The tool-steel center piece with the sharp taper thread is held in the outer case by dowel pins and can handle quite a variety of sizes without difficulty.

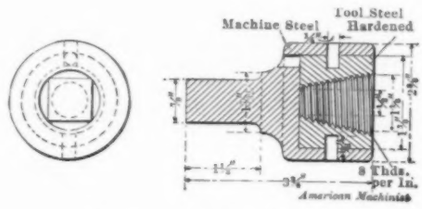


FIG. 6. STAYBOLT CLUTCH

Fig. 7 shows a pneumatic cylinder which is being used on the New York Central Lines as a feed for air motors. One end is made to fit the top of the motor case, while the other end has a cone center which fits in the end of the shell forming the piston rod. Air is admitted between the piston head and the cylinder and exerts a constant pressure on the drill while at work. This is always under control of the operator, and has been found very satisfactory in their practice.

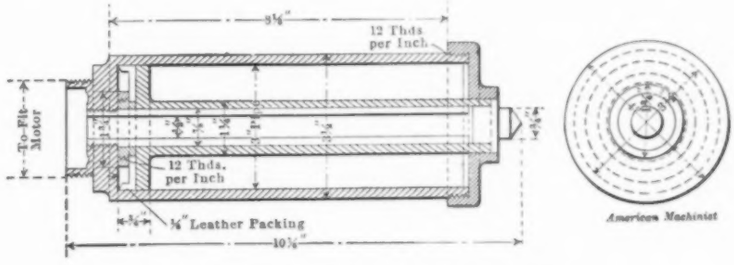


FIG. 7. PNEUMATIC FEED FOR AIR MOTORS

SELF-CENTERING MANDREL FOR PISTONS

Fig. 8 is a self-centering mandrel which was made particularly for turning 9½-inch air-pump piston packing but which is equally useful in piston-ring work of any size. The main part of the mandrel is the flange *A* which carries the annular ring *B*, and holds it on from the back. The clamping or follower plate *C* slips over the threaded end of the mandrel in the usual way while the ring *B* carries the compressing or locating ring *D*. The plate *C* is removed and a ring put on the mandrel fitting the raised portion or shoulder shown.

Then the plate *C* is slipped lightly into place and the ring *D* pushed over the piston ring, compressing it to its correct size and allowing it to be firmly clamped on the mandrel by the plate *C*. The ring *D* is then slipped back, leaving the piston ring free to be turned as in the usual way. By making the projection on the face of *A* longer, this can be used to turn up as many rings at once as may seem desirable.

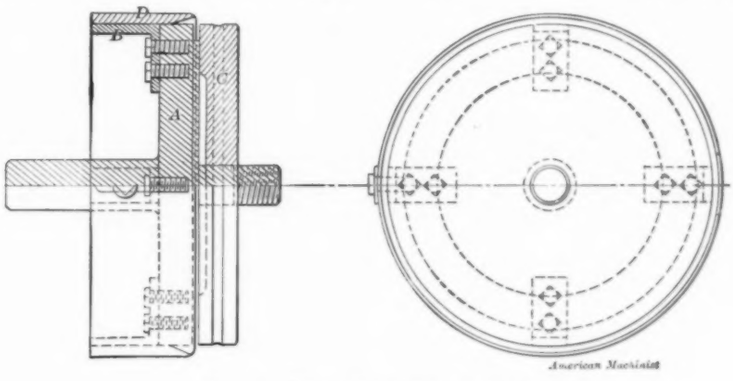


FIG. 8. SELF-CENTERING MANDREL

STRAIGHTENING PISTON RODS

A piston-rod straightening device to be used on engine lathes is shown in Fig. 9. The rod to be straightened is placed between the lathe centers over the bent lever *B*, which is pivoted in the tool slide *A* and carried at its outer end by the ball-ended screw *C*. This lever carries the blocks *D*, having two hardened-steel rollers, which are forced against the rod to be straightened at the proper point along its length. This lever is made up of two plates connected by bolts with thimbles for maintaining the correct distance apart as can be seen in the front view in the lower left-hand corner. This can be readily put in place or removed,

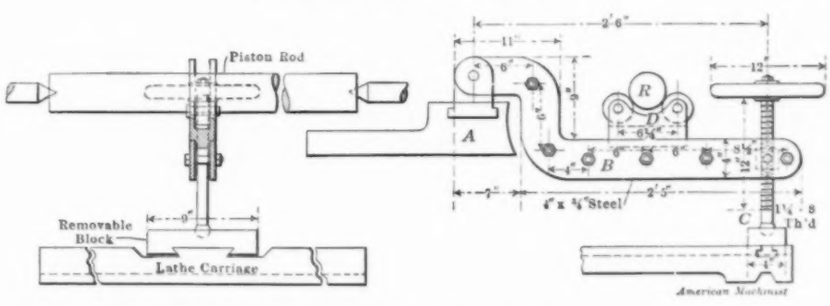


FIG. 9. PISTON-ROD STRAIGHTENING DEVICE FOR ENGINE LATHES

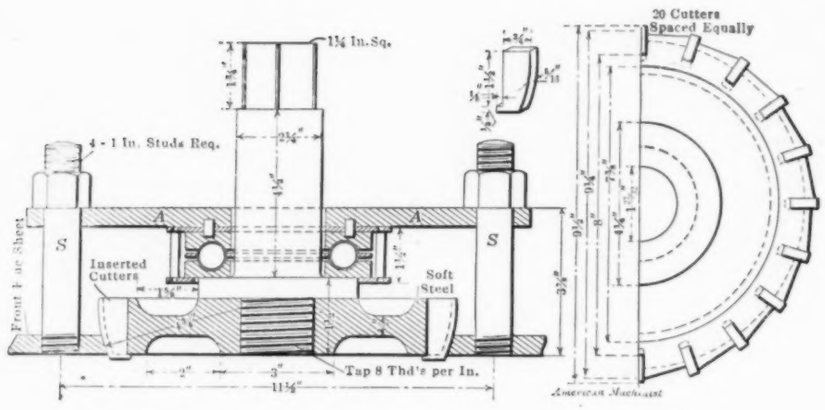


FIG. 10. BALL-JOINT FLUE-SHEET REAMER AND METHOD OF USING

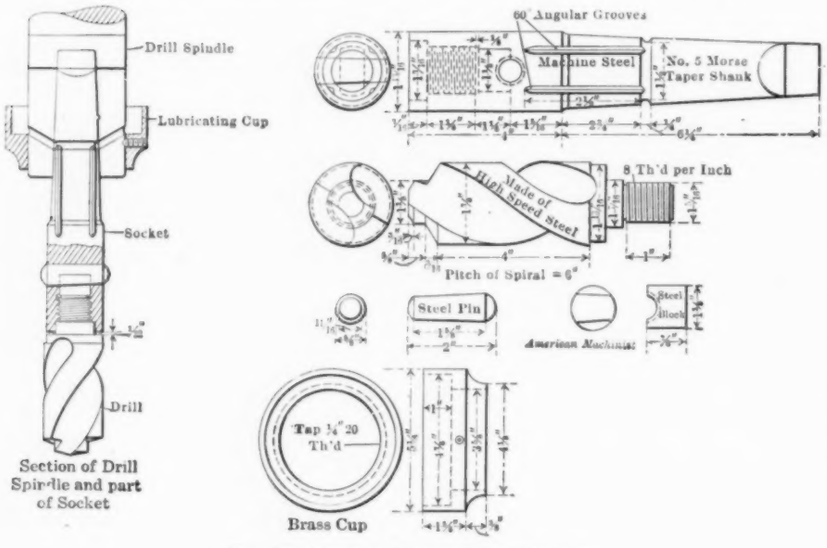


FIG. 11. SPECIAL FLUE-SHEET CUTTER

and has been found very useful in straightening bent rods.

The ball-joint flue-sheet reamer illustrated in Fig. 10 is somewhat unusual on account of the ball-thrust bearing which is used to support it and force it into the work. The method of operation is clearly shown, the reamer being in position in the front flue sheet and being supported by the studs *S S*, which are screwed into tap holes and support the strap *A* which carries the ball-thrust bearing before referred to. This reamer is used in facing the ball joint for the steam-pipe joints, and can be driven by a ratchet wrench or in any other way desired. All necessary details are given, even including the cutters which are inserted into the reamer body.

Fig. 11 is a special flue-sheet cutter in the nature of a short milled twist drill, which follows the punch and enlarges the hole to the proper diameter for the flue. It is held in a special socket by the threaded end shown, and has rather an interesting method of releasing, no matter how hard it has been forced in by the work. There is a steel block and taper pins behind the end of the drill, which takes the thrust of the end as it is screwed in. When it is desired to remove these drills, all that is necessary is to drive out the taper pins, relieving the pressure between the threaded end and the steel block and allowing the drill to be easily unscrewed by hand.

The method of oiling the drill is also of interest. The brass cup is fastened around the lower end of the drill spindle so that the bottom of the pin side of the cup comes even with angular holes, which have been drilled to meet the annular groove in the socket shank and here the oil runs to the cutting edge of the drill.

Japan has been a metric country for several years, but the new tariff uses kilograms and "kins" with impartiality, "kin" being the native unit and weighing about 1.32 pounds. This simply shows the difficulty in upsetting units which have been standard for many years.

Common Courtesy Pays

By C. C. Howe

You are at your desk—perhaps you are busy and perhaps not. The office boy brings out a card from Mr. Jones, a high-speed steel salesman. "Tell him nothing doing," you say. After a while the boy returns. "Mr. Jones said that he has something that will interest you and begs a few minutes of your time." You finally go out and sulkily listen to his yarn and get rid of him in the shortest time possible and in such a manner that he goes off "blessing" you.

It may be a tool-steel salesman or a pump man or a machine-tool salesman (they are the worst)—it is all the same. Now, unless you are married to your job or independent financially you will some day, sooner or later, require a favor or an interview, at least, with one or more of the salesmen or agents you have treated discourteously. The world moves; the salesman of today is the purchasing agent or the engineer of tomorrow. A man needs all his friends to successfully engage in any business. They cannot all be friends, but if you have acted fair and square an enemy will often grant a favor as quickly as anyone else. You would yourself, if you knew you were in the wrong.

The company selling tool steel or pumps may use your output; one day you call in answer to a complaint that has been made and find that you have to deal with a former salesman or traveling representative. Your manner in the former interview quickly comes to mind and you are liable to do some thinking that will govern such interviews in the future.

It is not at all necessary to purchase or recommend goods that you do not want or approve. Common courtesy is all that is necessary. Tell him you do not want his stuff in so many words and why you don't want it, if necessary; but be decent about it. Honest criticism is always appreciated by right-minded people.

You may be called from a far part of the plant to see something that does not interest you in the least, but don't get mad about it; at least, don't show that you're mad, which is more important. You don't know how soon you will call somebody just as far or further on a matter which is of no importance to him. If you cannot come right away, send word as to when you can, nothing is so soothing to the nerves and temper as continued waiting. At the end of an hour or so the man does not care whether he can interest you or not, but waits longer, perhaps, to see what manner of man you are or that he may know you the next time he sees you, preferably on his own ground.

Specifications for Air Hose

By R. D. Gatewood*

Methods of testing devised to govern the purchase of 50,000 feet of air hose for the Mare Island Navy Yard.

Testing for kinking as well as for pressure.

The specifications finally adopted.

*Assistant naval constructor, United States Navy.

When the question of the purchase of some 50,000 feet of air hose for use at the Mare Island Navy Yard was taken up several years ago, it was found that up to that time no definite specifications were in use under which this hose could be purchased. Applications made to the purchasing departments at other navy yards developed the fact that each yard purchased its hose under special specifications gotten out at that particular plant, and that hose was being used at one place costing 85c. a foot, while hose of a different nature used for exactly similar purposes was apparently answering all requirements at a purchase price of 35c. a foot. It was believed to be a highly opportune time to attempt the preparation of a uniform set of specifications covering all pneumatic hose for use at the various navy yards.

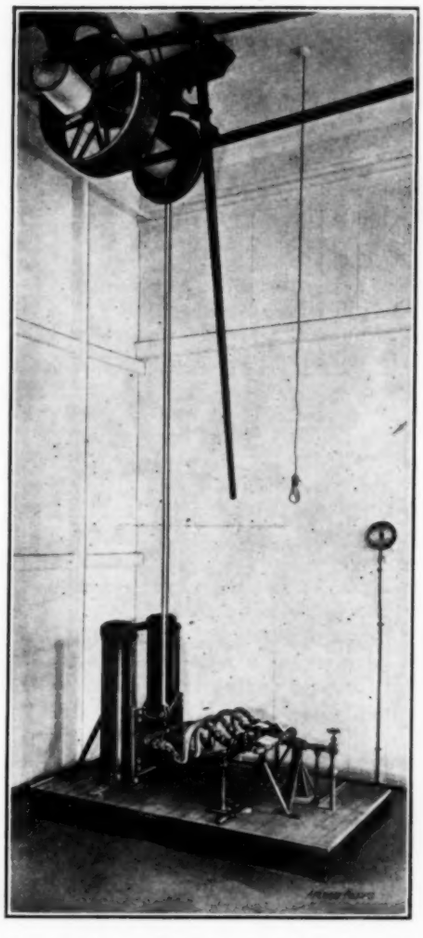


FIG. 1. HOSE IN PROCESS OF BEING TESTED ON KINKING MACHINE

Inquiries at large shipbuilding plants developed a similar state of affairs to that existing in navy yards; namely, that each plant bought its hose under its own specifications, all of them differing considerably in the matter of quality of hose, methods of testing, and, therefore, in price; nor did there seem to be any uniform opinion in regard to the actual requirements for such hose, either as to the size of hose to be used, whether it was to be armored or not, the number of cotton ply used in its manufacture, etc.

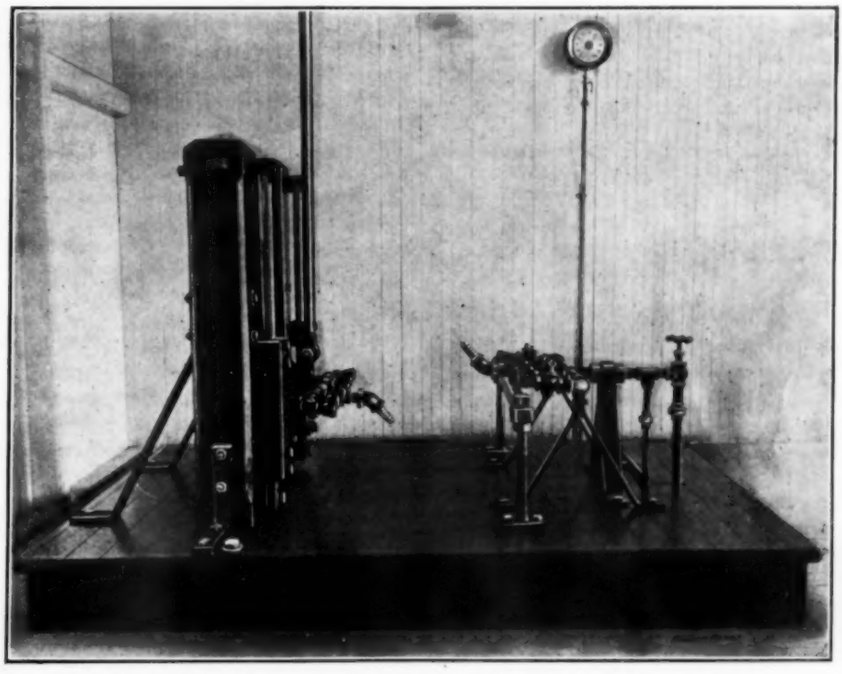


FIG. 2. NIPPLE CONNECTIONS FOR SECURING HOSE TO MACHINE

KINKING AND PRESSURE TEST

After quite a little investigation, it was decided to adopt a combination kinking and pressure test, and to this end the machine shown in Figs. 1 and 2 was developed. This machine, which is comparatively inexpensive, was adopted from a test made by the Burlington Railroad Company for testing the hose used by that company on air brakes. The actual test was conducted as follows:

A test piece 20 inches in length was fastened securely at each end by means of a number of elbow-nipple connections, the nipples being slightly corrugated. One inch of the nipple is allowed to enter the end of the hose, which is then secured by two bands of No. 7 B. & S. gage soft copper wire, hove up by a hand vise, so that when the machine is running the give of each sample is as slight as possible, and, as nearly as may be, equal to that of the other samples on the machine. It was found highly essential that all nipples be of the same length and that their ends be carefully rounded off in order to avoid the friction of the end of the nipple on the inner rubber tube. This point was found to be of the greatest importance and in any test of a similar nature too much care cannot be taken to prevent this friction, for it is upon the strength of this inner rubber tube that the ultimate strength of the hose depends. The length of 20 inches was decided upon after considerable experimentation. At first it was proposed to allow a different length for each size of hose, but as this introduced an additional variable, it was decided that for all practical purposes the above length was sufficient for hose from ⅜-inch to 1¼-inch.

The nipple connection above mentioned is made up on a 45-degree elbow, the stationary end being turned up and the moving end turned down. (See Fig. 1.) The distance between the ends of the couplings or nipples when level is about seven inches. One end remains stationary and the other end moves up and down through a distance of about 14 inches, by means of a crosshead work-

ing in guides, so that the hose is kinked about 80 times a minute. The kinking occurs in two places in the length, about four inches from each end, the angle through which the hose is bent being from 60 to 70 degrees. (See Fig. 2.) During the entire time the hose is being kinked, a pressure of 90 pounds per square inch is maintained on the hose, this pressure being the pressure at which the hose is required to work in service. In comparatively few instances in the kinking test was it found that the sample actually burst. The rubber covering of the hose frequently gave way, but this was not considered to be a material defect. The samples were carefully watched, particularly at the end of the specified kinking test, and if a slight leak was discovered the machine was stopped. If there was not found to be a steady flow of air, the machine was again started. If, however, there was a steady flow of air escaping, it was considered as denoting the end of the kinking time for that particular sample.

This specified kinking time was, of course, the hardest part of the specifications to determine upon, and after tests upon 20 different samples of hose submitted by different companies, the following requirements were decided upon:

Size of Hose.	Length of Test, in Hours.
⅜ inch	45
7/16 inch	40
½ inch	30
¾ inch	25
1¼ inch	3

In addition to the above kinking test, all hose was required to stand a hydrostatic pressure of 600 pounds per square inch.

In addition to the above requirements, the specifications were purposely made sufficiently loose to cover the ordinary commercial grades of hose in the matter of cotton ply. This was done in order not to limit the purchase of suitable hose to hose of special manufacture, such as is now used on vessels of the navy for fire purposes, the idea, of course, being to reduce the cost as much as possible and still obtain a serviceable article.

The kinking test on the large size (1¼ inches) was considered to be more or less comparative only. By means of this test on the large size hose, it is possible to pick out *some samples* that are *better* than others, but it is impossible to pick out the *best*. The results of the 600-pound water test were considered of more value as a measure of the quality of the large size hose than were those of the kinking test. The figure of 600 pounds was used entirely to determine the relative merits of the various hose samples submitted, as under ordinary conditions of service the hose would only be required to stand about 90 pounds pressure.

Standard Specifications

From the above test the following specifications were gotten up by the bureau of construction and repair, and are now in use for the purchase of all pneumatic hose used at navy yards under that bureau:

"1. The hose to be made up of an inner rubber tube, three or more canvas or braided layers, and an outer rubber cover; to be of the internal diameter required for.

"2. The tube and cover shall be free from pitting or other irregularities; the tube shall not be less than 1/16 of an inch, and the cover not less than 1/32 of an inch in thickness. The hose to be of the best quality rubber, duck and friction, and to be capable of standing a hydrostatic pressure of 600 pounds.

"3. At the time of submitting bid, and prior to the opening of bids, each bidder shall submit to the general storekeeper at the yard from which the hose is purchased, a sample of each size of the hose on which he is bidding. These samples will be submitted to the mechanical kinking test, and the award of contract will be based on the result, the bidder whose sample shows the best result as compared with the price bid will be given preference, the Government reserving the right to reject any or all bids. No sample shall be considered satisfactory that does not stand the test for the following length of time without leakage at 90 pounds air pressure:

⅜ inch	45 hours.
7/16 inch	40 hours.
½ inch	30 hours.
¾ inch	25 hours.
1¼ inch	3 hours.

"4. A sample from each delivery will be tested in a similar manner to demonstrate whether it is equal to the sample submitted with the bid.

"5 The kinking test is conducted as follows: The test piece, 20 inches in length, is fastened to couplings made up on 45-degree elbows, the stationary end turned up and the moving end turned down. The ends of the couplings when level are seven inches apart. The moving end travels vertically through a distance of 14 inches, and the speed is such that the hose is kinked about 80 times a minute, the kinking occurring in two places about four inches from each end. During this test an air pressure of about 90 pounds per square inch is maintained in the hose."

The adoption of the above specifications has resulted in the purchase at a very reasonable price of hose which is amply strong to withstand all service pressures, and at the same time of such construction and pliability as to produce good results in use. The test is of comparatively short duration and awards can be made almost immediately after receipt of bids, as the test can be conducted prior to the date on which the bids are to be opened, and it is only necessary to compare the results of the test with the bids in order to recommend award. While it is appreciated that the results do not indicate definitely the manner in which the hose will stand up in service, it is found by experience that hose which stands up well in the kinking test gives good satisfaction in service.

Inside Nurling on the Automatic Screw Machine

By S. H. Bacon

The piece shown in Fig. 1 is the only inside nurling job which I have ever seen. After the piece is completed, it is sent away to have rubber tubing inserted in the hole.

Formerly, the hole was recessed with a swing tool from the turret, to prevent the rubber from pulling out, but as there was always trouble due to the rubber turning, it was decided to nurl in the hole as shown by the sketch, as this would prevent the tube from pulling out as well as from turning in the socket. The piece is made on a Brown & Sharpe No. 2 automatic screw machine, and the material is ¾-inch machine steel. No trouble is experienced due to chips getting tangled with the nurling tool, as it is backed out of the way while the other tools are cutting.

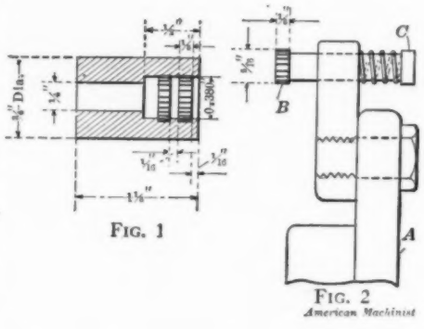


Fig. 1

Fig. 2
American Machinist

Inside Nurling on the Automatic Screw Machine

The nurl tool is shown in Fig. 2, and it shown clamped to the tool post *A*, in the same manner as a circular tool. When ready to nurl, the cam brings the nurl tool forward until the wheel *B* is opposite the hole, when a pin in the turret comes forward, pressing against the head of the stud *C*. This compresses the spring and moves the nurl wheel toward the spindle to its proper location, when the cross slide again advances, pressing the nurl into the stock. The nurl now drops back and the turret advances one-sixteenth of an inch for the second nurling. When the nurling is completed, the spring withdraws the nurl from the hole.

One View of Shop Organization

By Con Wise

The large and small gang methods of running a good-sized shop.

The manager who decides every detail of shop and office work for himself.

Cooperation in the modern methods makes for success.

Any time we wish to compliment a shop manager we tell him what a wonderful organization he has. I tried this on a friend of mine a few days ago with the result that I had my ideas of a shop organization badly jarred.

This man has between two and three hundred men working for him. Everything is cut up into small gangs averaging ten men each. Each gang is a little shop in itself, the men practically working for, hired by, and discharged by the gang boss, but drawing their pay from the company. These gang bosses take their orders from the manager direct. They are allowed no initiative and in turn they allow their men no initiative. The manager dominates everything. If Bill Jones, who works on Dick Wilson's job, thinks he could mill a tee slot quicker and easier than he can hook it out on the planer, he does not do it, simply because he would have to get Dick to take it up with the manager, and the manager would say in a second, "Not a bit of it. I decided 10 years ago to plane those tee slots, and I don't propose to change my mind."

This manager has literally planned every move made in the place. He could do it because he grew up with the business. He decides whether the countershaft friction on the 12-inch lathes shall be keyed or set screwed, and he measures them himself to see that the right length set screws are ordered. He asks no advice nor allows any suggestion to be presented to him. His organization is perfect, from his point of view. It does not talk back, it is automatic, his men are automatons.

Suppose an emergency arises. A planer bed is crooked. Who decides whether it will plane out, or whether it shall be heated and straightened, or returned to the foundry? The manager. Suppose an extra change gear is needed on the big lathe to cut an odd thread; who figures it and orders it? The manager. Suppose the elevator belt gets slack and the manager is in New York, attending a meeting for the advancement of upright drill prices? The belt goes slack till he returns.

Now I do not call that an organization at all; I call it a machine. The time has gone by for individual management. The man who must have his own way and who never solicits advice, has passed to stay. He has passed with the man who starts a business of any magnitude, alone. With the advent of the corporation, which marked the passing of the putting of all of one's eggs in one basket, began the distrust of any one man's final judgment on matters of business import. Today what concerns us is the coöperation of every element in the shop, from directors down to the man who sweeps up, and the largest question is the proper fixing of duties and responsibilities.

The Usual Modern Organization

A manufacturing concern today consists, first; of a body of stockholders, whose knowledge of the business may likely be limited to the size of the dividends, and who may be presumed to be agreeable to any management which produces satisfactory dividends.

Second; a board of directors, whose interests are the same as the stockholders but who, being more intimately responsible, have need of closer knowledge of what is going on.

Third; a manager, who is responsible to the directors, and who may be expected to have an accurate knowledge in general of what is going on.

Fourth; various department heads who have ability to plan and carry out work and are responsible to the manager.

Fifth; various foremen who have an intimate knowledge of the details of their particular parts of the work.

Sixth; skilled workmen who are doing the detail work, and whose experience in detail is the greatest of any part of the organization.

Seventh; operators and helpers; the purely "machine" element of the organization.

The modern organization relies on the coöperation of all these elements. It relies on the brains of all but the last. In order to get this mental coöperation something must be done besides hoping for it. The directors meet with the stockholders once a year at least. They are expected to, and do report as fully as the stockholders may request. The manager presumably meets with the directors monthly, or oftener. His reports are as full as may be demanded. He advises, and of necessity, his advice is taken unless it is very radical. These steps are universal.

Relation of Manager to Subordinates

The next important matter is the relation between manager and his subordinates. It is necessary in many ways that the word of the manager should be law to them, but if he be a modern manager, he will want to know their opinions of his methods, whether complimentary or not. Further, he should bear in mind that even war has changed from mass formations to individual and open action. Instead of sending out solid battalions to be mowed down by machine guns, we send out individual men to hide behind rocks and trees, and pick off the enemy, one by one.

With this in mind, the manager will see to it that his men are allowed every privilege that is consistent with the carrying out of a general plan, which has been settled upon by the directors and himself. He will aim to give each man that most desired of human feelings, that of independence, and to this end he will depend upon them, even in cases where his own whims or previous training might have indicated a different procedure.

Whether this is best accomplished by stated meetings, or by suggestion boxes, or by personal interviews, is an open question. The stated meeting is a convenient method of giving instructions, but is apt to be dominated by men who happen to have the gift of gab, or a fault-finding disposition, to the exclusion of the quiet man who may have the best ideas. The suggestion box is apt to be neglected and loses half its value because so few men know how to express themselves in writing.

The Personal Interview

Personal interviews I believe to be the best. This simply means that the man at the head, as he goes around the shop, stops to pass the time of day with his leading men and talks with them a bit, gradually drawing them out. A few weeks of this, if the manager is fair, dead fair, will put his men where they will tell him what he wants to know and where he can tell them what is what, without leaving a sore spot behind.

I realize fully that this method can readily be so abused as to be worse than useless. For example, suppose that as the manager comes around he meets B, who is a gang boss. B calls his attention to a certain gear which he could, or thinks he could get out faster, if he had a hole drilled through the web to drive it by. He says that he told C, his department head, about it, but C turned it down. There are three things the manager can do. He can back up the department head; in which case B will be less likely to make suggestions the next time. He can go to C and ask him if any suggestions have been made recently, and draw out from him what his objections were to the scheme. He can then go

back to B and tell him that C is in a mood to hear him again, or that he has talked with C and they agree that for certain reasons it will not pay to make the change. He may take B right over to C and talk the matter over with both at once.

The last two leave a good taste in B's mouth and they show C that, while his opinion is respected, the management wants the best idea without regard to its source. Both lead B to further coöperation, without having a tendency to make him "chesty." That is what is needed; coöperation all along the line.

FREEDOM FROM PERSONAL PREJUDICE

Another thing that tends to stability of modern organization is the tendency to make employees less subject to the whims of foremen. The tendency is to transfer men from one department to another, rather than turn them out. This is done on the basis that it is always possible that the reason a man is found unsatisfactory, is the fault of his foreman. Often it has happened that a firm has found that an element of success in a competitor is a man who was discharged from their own factory because he could not get along with some foreman. Under another man of a different temperament he has proved his value, to the loss of his first employers. It is being recognized that men should not be discharged lightly, but that every effort should be made to find where they fit, before they are allowed to go.

Again, the question of wages is one that should be passed on by someone in possession of the facts as to the cost of the earner's production, and also by someone in immediate contact with the man himself, so that two very essential facts can be determined; one, as to his own earning capacity, the other as to the way in which he fits into his surroundings and whether or not he coöperates and promotes the efficiency of the shop as a whole. All of us know of cases where a man accomplishes a great amount of work and yet does it in such a way as to cut down the efficiency of everyone around him.

Pressing Locomotive Rod Grease

By J. W. Shadle

The practice of the Chicago & North Western Railway in preparing lubricating grease for its side-rod cups.

The press used, with full details as to how it is made.

Fig. 1 gives a general view of a home-made grease press and automatic cutter that presses and cuts to length all rod-pin grease, for the Chicago & North Western Railway Company, which is then boxed and shipped to all terminals on the system. The grease is manufactured in the paint-shop department under Foreman O. Rosenberger, who deserves credit for suggestions made and efforts put forth in perfecting this economical rod-cup grease plant. The air cylinder is made from an old 19½-inch cylinder bushing. The piston head has leather on both sides, one leather holds the air to force the 17 31/32-inch piston against the grease while the other leather holds air to return the piston to its normal position.

The grease cylinder is made from an old 18-inch cylinder bushing and holds 168 pounds of grease. The grease cylinder is pivoted to the bedplate at the front end and held central and in line with the air cylinder by a key and pin bolt. When the grease cylinder is ready to fill it is swung outward, a 168-pound stick of grease is inserted and air applied to the air cylinders. The grease is

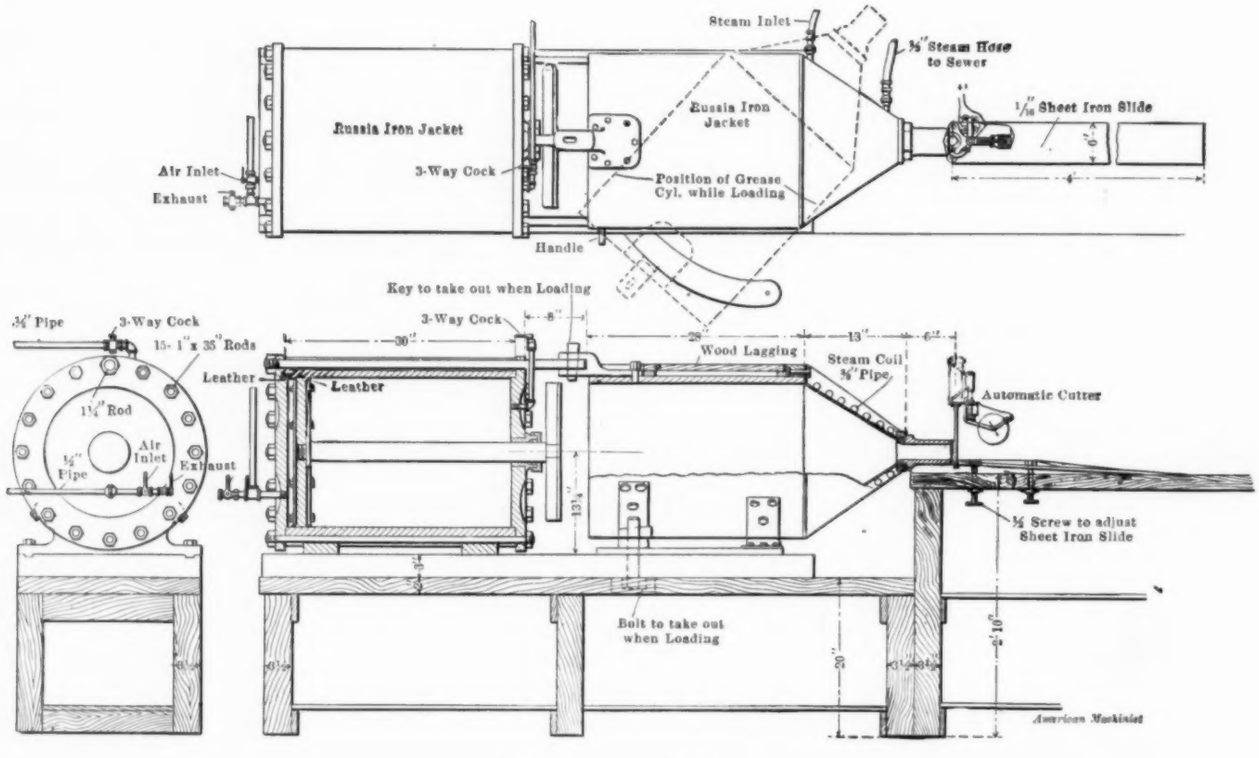


FIG. 1. ROD-GREASE PRESS

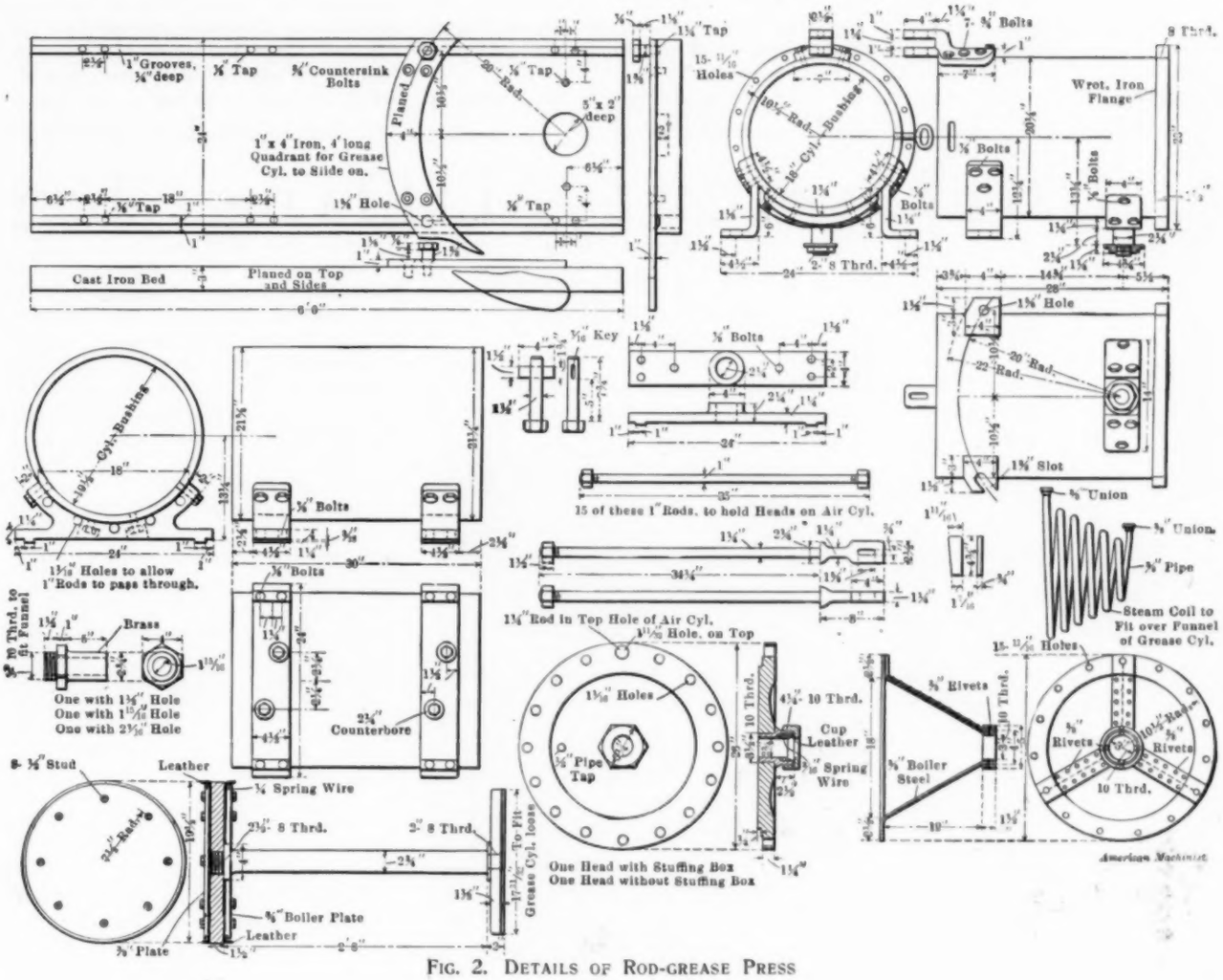


FIG. 2. DETAILS OF ROD-GREASE PRESS

forced through a nozzle of the proper size in the tapered front cylinder head. The grease passes under the wooden roller of an electric cutter which cuts the grease sticks in lengths of one pound each, after which it is packed in boxes ready for shipment. The front head on the grease cylinder is cone shaped and has a coil of steam pipe around it which helps the grease slide through with ease.

Fig. 2 gives the details of the rod-cup grease cylinders, pistons, bedplate, frame, etc., with all dimensions, and is sufficiently clear to be fully understood by all interested, without further explanation.

Getting Past the Inspector

By John R. Godfrey

One of the mysteries of the machine shop is the way in which glaring errors sometimes get by the inspector.

I recently saw a certain machine tool, built by one of the best firms in this country where inspection is usually very rigid, that might have passed as a joke, if it had not been such a standing advertisement of the wrong kind. The mistakes stuck out all over it, and the user took an unholy delight in pointing them out to all comers.

Holes for oil cups were crooked so they stood at all angles, set screws followed suit, split clamps could not be made to clamp even themselves, with other defects too numerous to mention.

Some of them were simply ludicrous, while others affected the efficiency of the machine. But in either case, it is more or less of a mystery how they ever got past the inspector and why such a machine should be shipped as a perfect product. Or is it just possible that the inspector saw some, if not all the defects and had a special reason for passing it?

A POSSIBLE REASON

When you are working like a Trojan to get a machine out for a customer who makes life miserable for you by letter, wire or 'phone, all hands and the cook get sort of nerved up over it and some things are apt to go askew. Such a condition of affairs might easily account for tapping holes out of square or making similar nonessential mistakes.

And it would be very natural to suppose that the customer would prefer to have the machine in order to get its product, than to wait until such mistakes might be rectified. This, of course, does not or should not, apply to errors which affect the output of the machine in any way. In such a case it would probably be a wise plan to notify the customer of the facts of the case and tell him the machine is shipped in this way as an accommodation to him.

It is just possible, however, that the machine was one of a lot ordered by a dealer, who was doing the hurrying act, instead of the customer, so that the customer himself would never know that the

builder was driven to distraction, even if the dealer did.

But it is extremely doubtful if it ever pays to let an imperfect machine go out, even to accommodate a customer who may know all the reasons. He may appreciate them at the time but he is more than apt to forget to tell visitors how it all happened.

Then too, the machine may easily be sold into other hands. But as long as it exists, it is a constant reminder of the fact that a machine which was not perfect, as we consider perfection, was allowed to leave your shop.

A Convenient Milling Jig

By Ulrich Steiner

This is a case where the problem of holding the work required considerable study owing to the peculiar shape of the piece. This was a difficult piece to hold as can be seen. In order to machine both face and feet at one setting, the holding plate of the jig is supported on centers or trunnions, as can be seen in the detailed illustration.

Fig. 1 shows a milling jig for the shifting pinion brackets of the Landis grinder, one of which is shown on the milling-machine table. The machining of this part consists of milling the feet *A A*, and the dial *B*, both of which are accomplished at one chucking.

Figs. 2 and 3 show a front and side elevation of the jig. In Fig. 2 will be seen a yoke *C*, provided with a stud. The casting to be machined is slipped over this stud, the back side of the dial resting against the pins *D D*, Fig. 3. In this position the feet of the casting are milled.

To mill the dial the screw *F* is removed and the screw *G*, Fig. 2, is loosened. The yoke with the work fastened to it is then revolved one-quarter of a turn, bringing the dial part on top. The block, Fig. 4, is placed on the finished spot *H*, Fig. 3, acting as a support for the yoke, which is firmly held down by the clamp, Fig. 5, slipped over stud *I*, Fig. 3, one end resting on post *J*. The screw *G*, of course, also is tightened.

There are many other places where the introduction of such a holding plate will allow difficult work to be held so as to be machined with very little trouble. By carefully locating the piece on the plate very accurate work can be done.

FIG. 1. MILLING THE SHIFTING PINION BRACKETS OF THE LANDIS GRINDER

In a consular report it is noted that for purposes of grinding flour, pumping water, running cinematographs, etc., in European Turkey, small petroleum engines are in demand, on account of low cost of fuel for that type of engine in those parts.

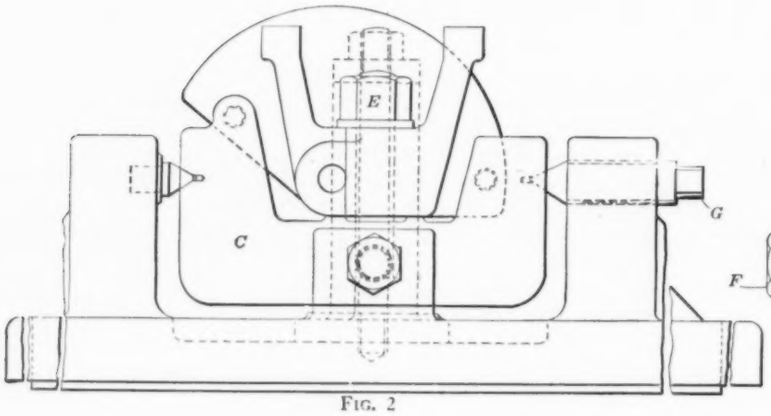


FIG. 2

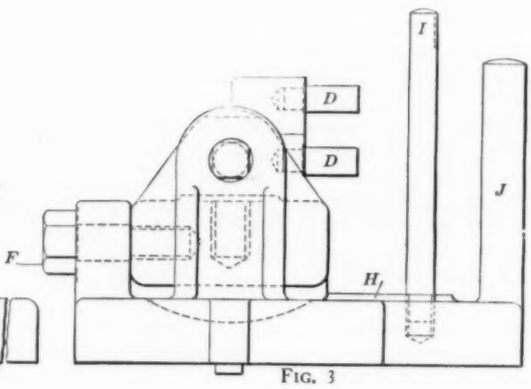


FIG. 3

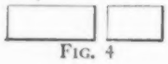


FIG. 4

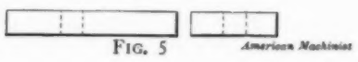


FIG. 5

DETAILS OF THE JIG

Setting Tires on Small Work

Editorial Correspondence

Convenient appliances for handling wheel centers and tires in shrinking them in place.

An unusual application of autogenous welding.

One of the problems involved in the manufacture of mining locomotives is the shrinking on of the tires on wheels of various sizes. The Goodman Manufacturing Company, Chicago, Ill., has a very convenient arrangement for doing this, as can be seen from the accompanying illustrations.

Fig. 1 shows the heating bench and cooling tank and beneath the bench can be seen a number of different burners, which accommodate the different sized wheels.

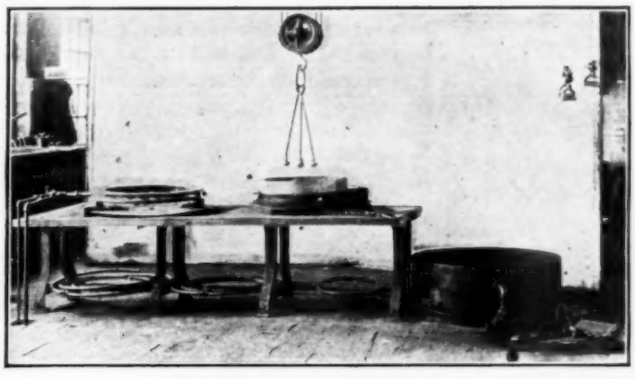


FIG. 1. HEATING THE TIRE

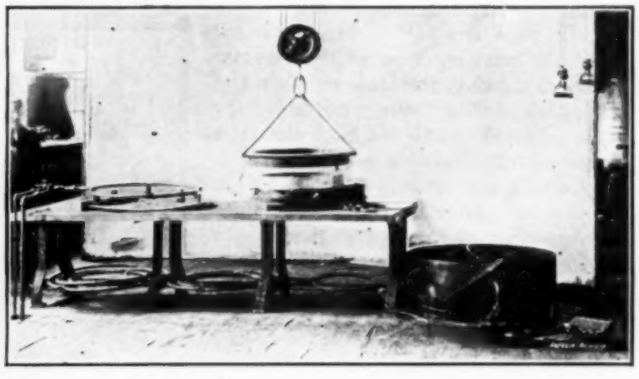


FIG. 2. PLACING THE HEATED TIRE

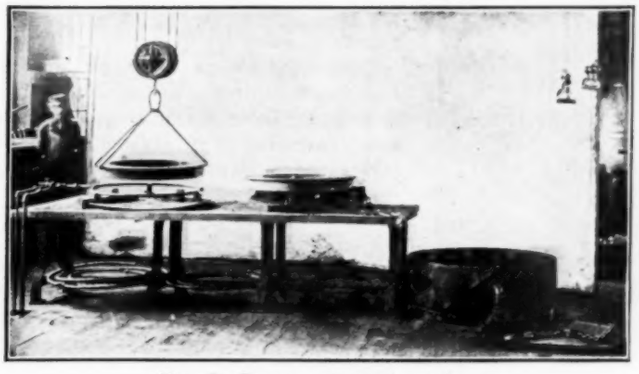


FIG. 3. PLACING THE NEXT TIRE

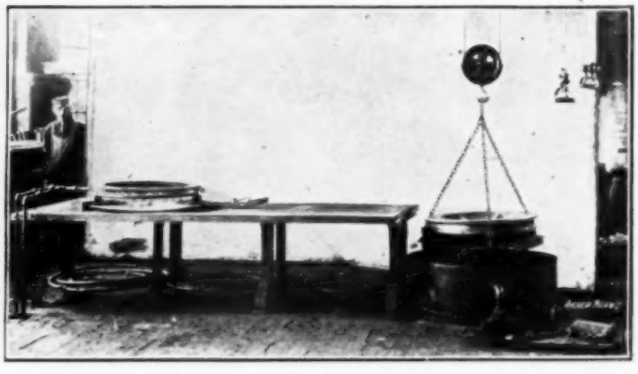


FIG. 4. COOLING THE WHEEL

FIG. 5. WELDING STEEL SHOE ON CASTING

The wheel center is placed on the triangular-shaped plate at the right of the table, this plate being provided with chains at each corner, which are connected to a ring so as to be readily lifted by the crane hook.

The tire is lowered inside the heating burner at the left, and as soon as it has been heated sufficiently to expand it enough to drop over the wheel center easily, it is picked up by the three hooks, carried over the wheel center by a light crane and easily lowered into place. Here it comes against three locating points which insure its being properly set; then a new tire is placed inside the burner to be heated for the next wheel.

The crane then picks up the triangular plate with its load and lowers it into the cooling tank at the extreme right, as indicated in Fig. 3. This makes a very complete tire-setting plant and one that occupies very little room, enabling the work to be handled very quickly and economically.

AUTOGENOUS WELDING

Autogenous welding is also used quite extensively in this shop, quite a novel application being shown in Fig. 5.

This is a shoe or casing on which the chain of coal cutters run, bearing on the lower edge and wearing out the casting quite rapidly. So a strip of steel is first lightly riveted on to take this wear, and afterward welded to the casting, as shown. This insures its remaining in place as long as there is anything

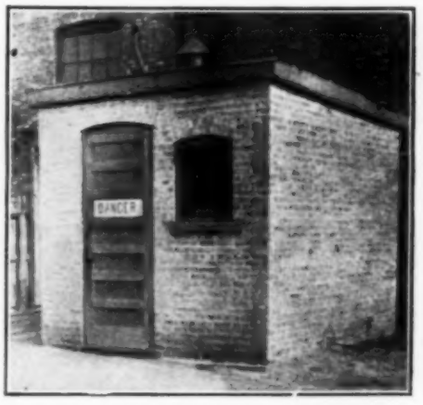


FIG. 6. HOUSE FOR THE ACETYLENE GENERATOR

left of it and entirely does away with the annoyance and expense of having these plates come loose after the rivet heads have been worn off.

Their autogenous welding plant is very complete, the acetylene generator being inclosed in a small brick building built especially for it and only accessible to the man in charge. This is shown in Fig. 6, and gives a good idea of a safe and substantial construction for such a purpose.

It is also interesting to note the way in which this work is held to be welded. It is rather an awkward shape to handle, so it is bolted against a flat plate which is mounted on the end of a short shaft, the shaft being carried in a pair of ordinary shafting hangers, which are inverted on the stand shown.

The pulley on the shaft between the hangers has a strap brake, which is controlled by the coil spring shown and is sufficient to hold the work in any position to which it may be turned for convenience in getting at it. As will be seen, the operator uses a soft-steel wire, which is melted and blown into any spaces that may exist between the steel strip and the casting.

Machines for Wire Rope and Cable

Special Correspondence

In this type of wire-rope machines, the reels are given a backward turn to prevent twisting the strands, this motion being produced by an eccentric ring revolving at the end.

In the accompanying halftones are shown several machines for the making of wire rope and cable. Figs. 1 and 2 show the ordinary type of cabling machine, this being provided with what is known as the back-turn motion for the reels. The object of this back motion is to prevent the twisting of the wires as they are laid around each other by the rotation of the frame, and it is obtained by means of the eccentric ring shown at the nearer end of the machine in Fig. 1. This ring, rotating upon an axis different from that of the main cradle, causes the short cranks to rotate backward about their own axes, relative to the frame, and thus to hold the reels which are mounted upon these axes so that as they revolve about the main axis of the cradle they do not rotate about their own axes. Fig. 2 shows the wire strands coming from the reels and led to the laying block at the right-hand end.

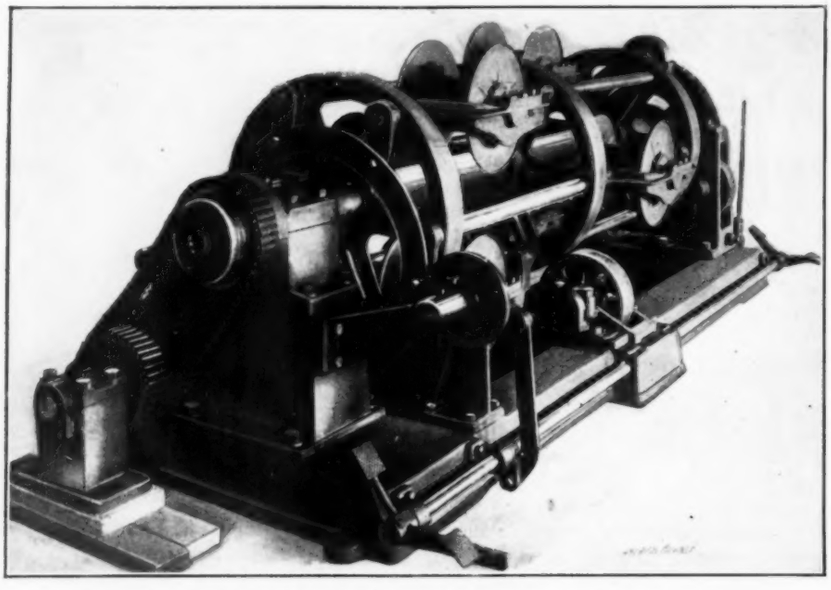


FIG. 1. WIRE-CABLING MACHINE WITH BACK MOTION

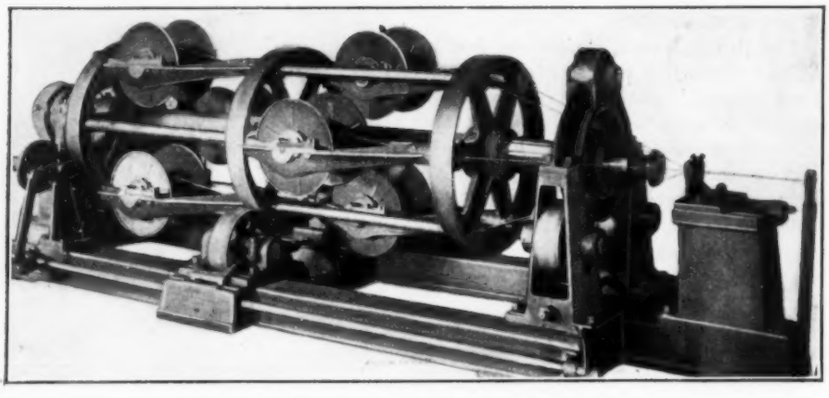


FIG. 2. FRONT VIEW OF CABLING MACHINE

Machines of this character, when of large size, have to be especially designed with relation to the centrifugal force of the reels revolving with the frames at high speed. This can well be appreciated when it is stated that a machine having reels 21 inches diameter by 10 inches width will run at 200 revolutions per minute and each reel holds 650 pounds of wire.

Figs. 3 and 4 show two sizes of seven-reel machines of the high-speed, or English, type. These machines are used for making seven-wire strands and also for laying up the seven-wire strands into a rope or cable. It will be seen that in these machines the reels are at the center of the cradle and do not revolve, so that no twist is put into the wires and no backward motion is required to overcome this. The frame revolves around the reels and is supported upon rollers, upon which turn several rings located along the length of the frame. Fig. 3 also shows the measuring device for measuring the product.

The machine illustrated in Fig. 4 is of considerable size, as will be appreciated when it is said that the floor space occupied is about 39 feet by 4 feet, and when fully loaded carries from 1700 to 1800 pounds of wire. It operates at a speed of 400 revolutions per minute. Change gears are provided for producing lays from 1¼ inches to 5 inches.

In Fig. 5 is shown another high-speed English-type machine, designed for making 19-wire strands in two operations. Here again the reels are at the center of the frame, which revolves about them. In this case the front reel of all is larger than the others, it being of sufficient size to hold seven times the amount of wire. In making the 19-wire strand, the 7-wire strand is first made, either on a 7-wire machine or on this machine with seven

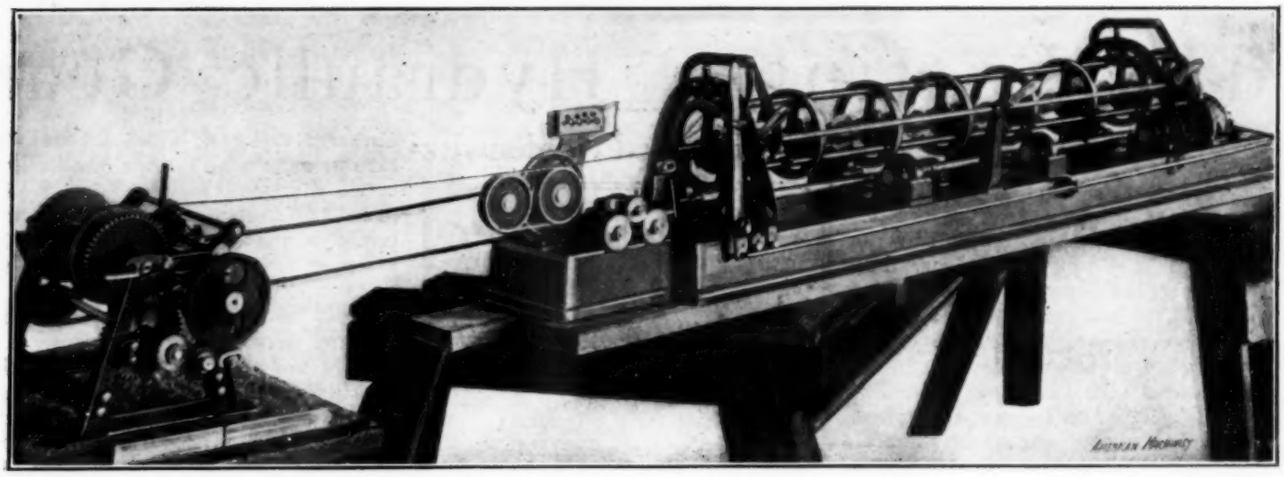


FIG. 3. SMALL ENGLISH TYPE MACHINE

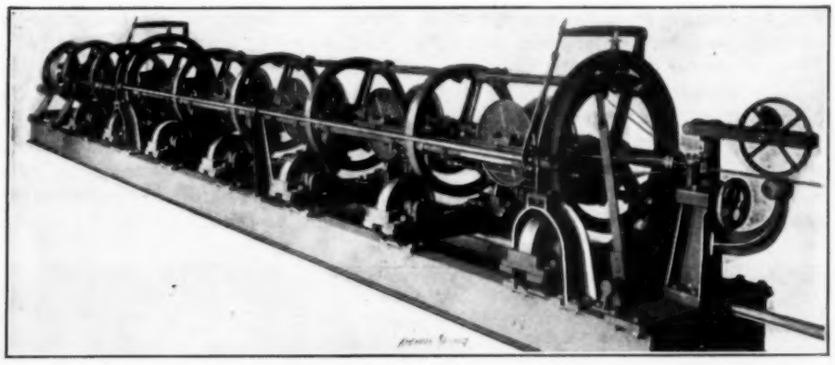


FIG. 4. LARGE HIGH-SPEED 7-REEL ENGLISH TYPE WIRE-CABLING MACHINE

of the reels in use. This 7-wire strand is then placed in the large front reel and 12 wires are laid around the 7-wire strand, either in the same or in the opposite direction. Here again will be seen the measuring device for determining the length of cable manufactured.

All of these machines are equipped with handy and powerful brakes for stopping and holding the parts at any time.

It is through the courtesy of the New England Butt Company, of Providence, R. I., that we are enabled to show these illustrations.

Simultaneous Milling and Boring on a Miller

BY E. A. DIXIE

The other day I saw a very interesting example of the flexibility of the electric drive. A casting, whose general shape was rectangular, about 6 ft. long by 2 ft. square, was to be machined on three sides and a hole approximately 16 inches in diameter was to be bored through the center from end to end.

It was mounted in a suitable jig (as there were many to machine) bolted to the table of a very heavy slab-milling machine. Suitable heads carried cutters which milled the top and two sides. Mounted on the table of the machine was a boring bar driven by an electric motor and with it the boring of the center hole was carried on simultaneously with the milling of the three sides. The bar, its electric-motor drive and feed were entirely independent of the milling-machine drive and feed.

It is quite possible to imagine a rectangular piece requiring milling on five sides, i.e., both sides, the top and both ends. A job of this character could easily be done with an arrangement similar to that described by mounting facing heads on the boring bar if there is a through hole in the casting, or using separate drives on each end if there is no hole.

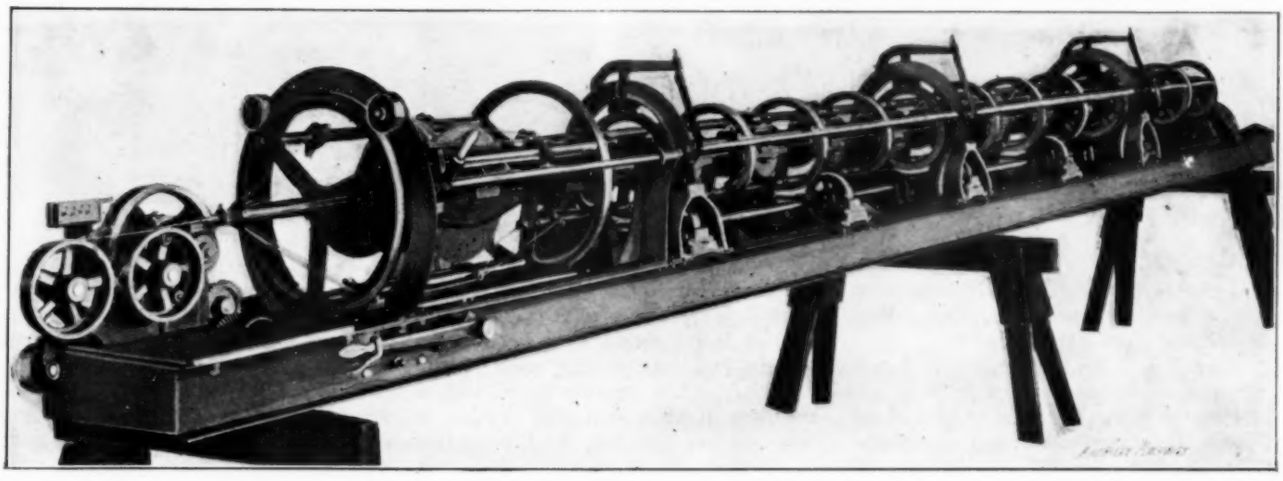


FIG. 5. 19-WIRE ENGLISH TYPE MACHINE

The Föttinger Hydraulic Gear

By Dr. Alfred Gradenwitz

Reduction and reversing gear for turbines with an efficiency ranging between 75 and 85 per cent. Gas and oil engines offer inviting field for the gear.

The two most serious difficulties met with in adapting the steam turbine for the purpose of ship propulsion are the impossibility of simple reversing and the necessity of maintaining speeds of revolution five to fifteen times higher than the number of turns of the best propellers. The best solution so far suggested for this problem, outside of the reducing gears recently developed, are the Parsons series coupling of various turbines mounted on different shafts, and the self-contained single-shaft turbine developed by Curtis and the Allgemeine Elektricitats Gesellschaft.

In spite of the excellent results obtained by these ingenious schemes, the hopes entertained at the beginning have been only partially realized, owing to the undoubted drawbacks inherent in an immediate coupling between the turbine and propeller, and the resulting necessity of choosing a compromised speed.

Prof. H. Föttinger, chief engineer at the Vulcan shipyards, has found a solution of this problem, which allows steam turbines to be used for ship propulsion under more economical conditions than have heretofore been possible.

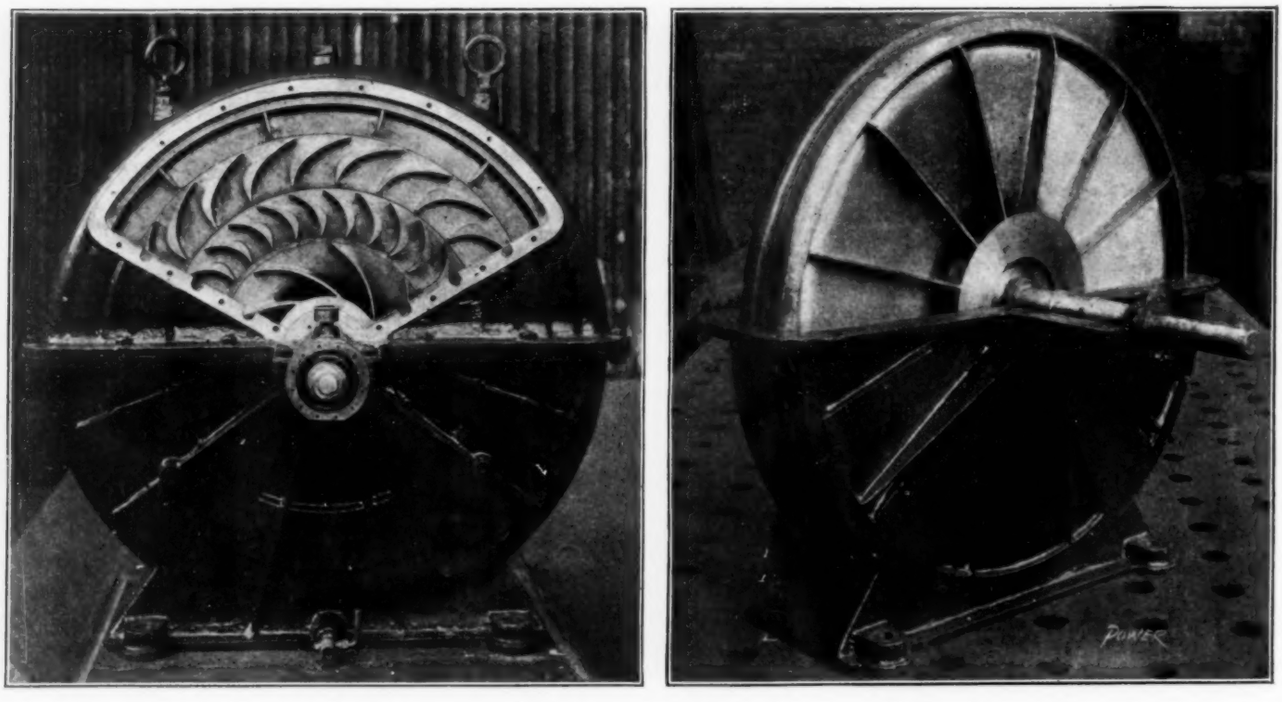
According to his scheme, a slowly running, highly economical propeller is operated by a high-speed turbine working under the most economical conditions, through a gearing of an efficiency of about 75 to 85 per cent. Föttinger's means of power transmission is an improved hydrodynamical gear.

According to the most primitive arrangement such a scheme would comprise (Fig. 1) a prime mover, transmitting its energy to a turbine wheel *A*, mounted on the primary shaft, e. g., the wheel of a centrifugal pump, which draws in and compresses the working liquid derived from a reservoir. The high issuing speed of the working liquid is slackened down and partly converted likewise into useful pressure behind the primary or pump wheel, in what is called an effusor, viz., some kind of guiding wheel *B*. From this effusor the liquid enters a spiral casing *C*, collecting the different jets and yielding them to the conduit *F*, which communicates with a secondary turbine. In Fig. 1 this is represented as a Pelton wheel, consisting of a guide *G*, reconverting the high pressure of the liquid into speed, the turbine wheel proper *H*, which is mounted on the secondary shaft, and a discharge casing *K*, which supplies the exhaust water to an exhaust conduit, connected with some reservoir, river or the like. The working medium can be returned to the suction reservoir, or the pump, in order there to be further utilized.

Now, though the efficiency of this primitive arrangement is obviously extremely low—less than 70 per cent.—a similar scheme has been recently suggested for the propulsion of ships and automobiles. The space and weight requirements are, however, objectionable.

Quite different conditions are met with in connection with the new hydrodynamical transmission gear developed by Professor Föttinger, which forms the essential part of his invention.

As represented in Fig. 2, this gear comprises a turbine wheel *A*, mounted on the primary shaft, which transmits the energy it receives to the entering working liquid, e.g., water, partly by acceleration and partly by an increase in hydraulic pressure.



THE TURBINE TRANSFORMER

Whereas, in the primitive arrangement shown in Fig. 1, the issuing jets as far as their entrance into the turbine undergo a double conversion of energy, viz., first from speed into pressure in the pump effusor and then from pressure into speed in the turbine guide, this double conversion is done away with in the present case, the issuing jets being conducted immediately onto a turbine wheel operating the sec-

ondary shaft, and which concentrically surrounds the pump. In the secondary wheel *B*, Fig. 2, the water is deprived of most of its energy. The issuing jets penetrating into the stationary guiding wheel *C* are there arranged conveniently in order to be thrown back immediately into the pump, with a loss of energy as small as possible, after which the same alternation of energy conversion, acceleration in the pump wheel and performance of work in the secondary wheel, is repeated over again. The water thus flows only through the turbine wheels immediately serving for the transmission of energy, which wheels are so designed and combined with one another as to constitute an entirely closed cycle formed by the side walls of the various wheels, from the primary wheels to the secondary wheel and back again. This cycle takes the shape of a hollow vortex comparable to a smoke ring. The usual form of the water-turbine wheel has been abandoned entirely and been replaced by a thorough rearrangement adapted to the purpose at issue. Fig. 3 shows schematically the wheel paddles "unwound," as used in the present case.

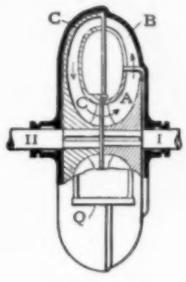


FIG. 2

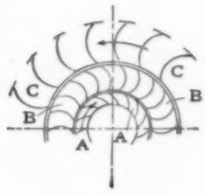


FIG. 3

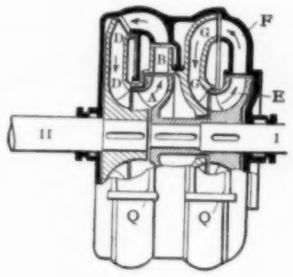


FIG. 4

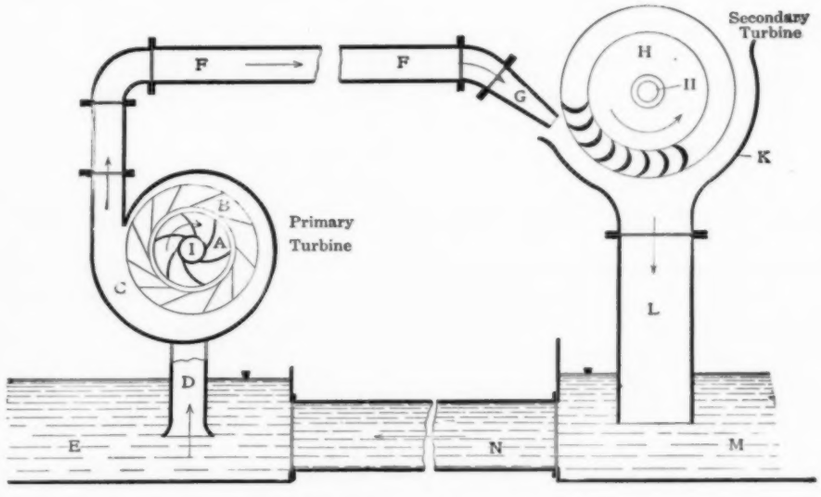


FIG. 1. PRIMITIVE ARRANGEMENT

Fig. 4 shows in its left-hand half an arrangement with double-stage secondary part, in connection with which the working water from the pump *A* penetrates into the first secondary wheel *B*, thence into a stationary guide *C*, and finally into the second secondary wheel *D*, in order thence to return to the turbine. The higher the ratio of transmission, the greater will have to be the number of secondary wheels. The same arrangement can be reversed by designing the pump with several stages, with a view to conversion to higher speeds.

At the recent meeting of the German Society of Nautical Engineers, Professor Föttinger demonstrated this very important double-stage arrangement on a working model actuated by an electric motor. The capacity of this model was about seven horsepower, the transmission ratio being 5 to 1; the primary speed 400 revolutions per minute and the secondary speed 80 revolutions per minute. The secondary speed could be adjusted to any figure intermediary between no load and stopping by a self-regulating brake.

Now, the most important question arising in connection with the new arrangement obviously relates to the efficiency to be attained. Theoretical considerations show this efficiency to be 80 to 82 per cent., in the case of large units, with a four- to five-fold transmission, and these results have been borne out by actual practice. In order to allow these facts to be adequately gaged, Professor Föttinger discussed the efficiency obtainable in the case of some low-pressure turbines of the best makes and some modern water turbines constructed by the greatest German turbine factories. In the former case were found efficiencies of 85 to 86 per cent., and in the latter case of 84 to 85 per cent., even with small units. While these figures apply to pumps and turbines in connection with which part of the water energy is allowed to go to waste, the use of the Föttinger turbine transformer would insure at least an additional 3 per cent.

The efficiency of the hydrodynamical transformer obviously depends on the ratio of transmission. In the case of a four- to six-fold transmission, 80 to 82 per cent. can be readily obtained with two secondary stages, while an eight-fold transmission can be effected with three stages and an efficiency of about 80 per cent.

The total efficiency of the plant can, however, be further increased by recovering the heat losses. Whereas in the case of directly operated propellers, 5 to 15 per cent. of the output of the prime mover is continually given off to the sea water, with a view to allowing of a high number of turns, the energy losses of the Föttinger transformer can be recovered almost entirely, being transmitted to the feed water, which is then preheated permanently from 20 to 25 degrees Centigrade, without the use of any coal. The feed water merely would circulate through a hydrodynamical transformer. The temperature then is maintained automatically at practically constant figures with different loads, as in the case of smaller amounts of condensed water there are produced smaller heat

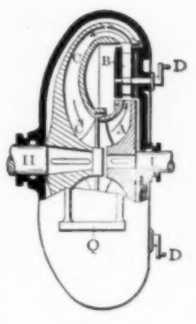


FIG. 5

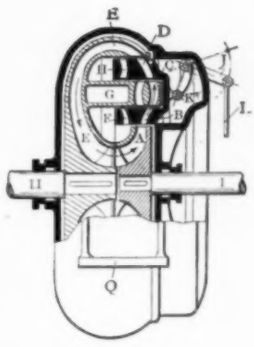


FIG. 6

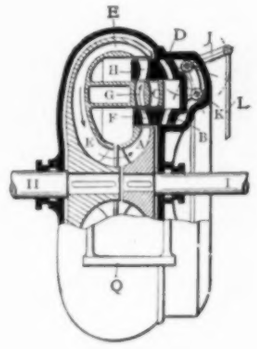


FIG. 7

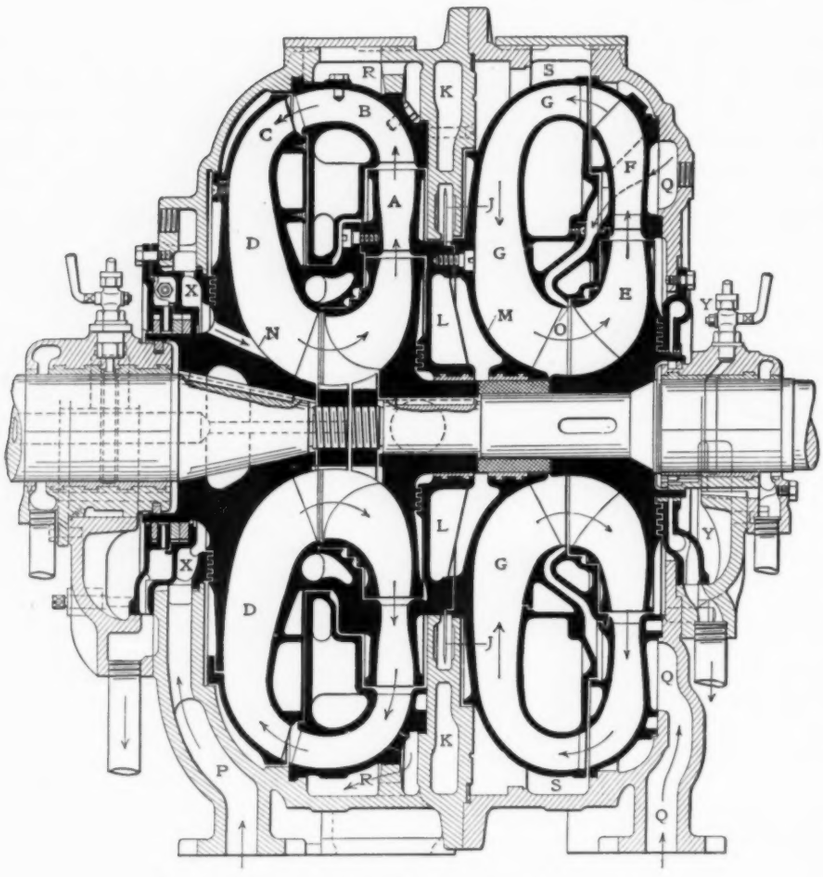


FIG. 8. SECTION THROUGH HYDRAULIC TRANSFORMER

losses; this arrangement increases the efficiency of an 80 per cent. transformer to 83 per cent.

The very important problem of steering, and especially reversing, can be solved in three different ways, the steam turbine, controlled by a regulator, continuing in each case to run in a constant direction.

The first method consists of designing a special self-contained cycle for each direction. Another method consists of using part of the turbine wheels, e.g., the pump and a secondary wheel, both for forward and backward traveling, and effecting the reversal by altering or exchanging the guiding devices. Fig. 5 represents a single-stage arrangement of this kind with rotary vanes *B* reversed simultaneously by the outside cranks *D*. Fig. 6 shows another modification of this.

A third possibility, which especially applies to the case of a very rapid reversal, consists of leaving the cycle in question filled while rendering it inactive by some kind of slide (rotary paddle or the like).

The question of regulation, that is, adjusting to different outputs and speeds, is closely connected with the steering problem. In the case of a constant transmission, the output absorbed varies with a given transformer in the ratio of the third power of the number of turns. Now, as this law is true, with a very close approximation, also in the case of the ship propeller, the transmission in the case of ship propulsion remains constant, even without any special regulation device and the same applies within very wide limits to the efficiency of the arrangement.

Another regulating process consists of altering the number of stages. In addition to these various steering and regulating devices the inventor has patented a number of other possibilities.

Results of actual tests on a 100-horsepower experimental unit bear out all the points provided by theory. The primary output was found in the case of different primary speeds of rotation, with constant ratios of transmission, to vary approximately as the third power of the primary number of turns. If, however, the primary number of turns be kept constant, the secondary speed being varied by means of the brake, the absorption of energy will remain independent within wide limits of the secondary number of turns. The secondary torque, with a constant primary speed, was found practically to follow a rectilinear curve in a similar manner to ordinary head turbines. The torque, in case of stoppage, was found to increase considerably (in the same manner as with a reciprocating engine), which results in the advantage of an instantaneous starting and a very rapid running up to speed. The maximum efficiency of 83 per cent. within wide limits of primary speeds was found to correspond to a ratio of 4.25 to 1, whereas the calculated value was 4.45 to 1.

As regards the variation in efficiency with variable primary speeds, i. e., variable primary outputs, a figure of 75 per cent. was obtained with 9½ horsepower; with 40 horsepower, 80 per cent.; with 100 horsepower, 82½ per cent., and final-

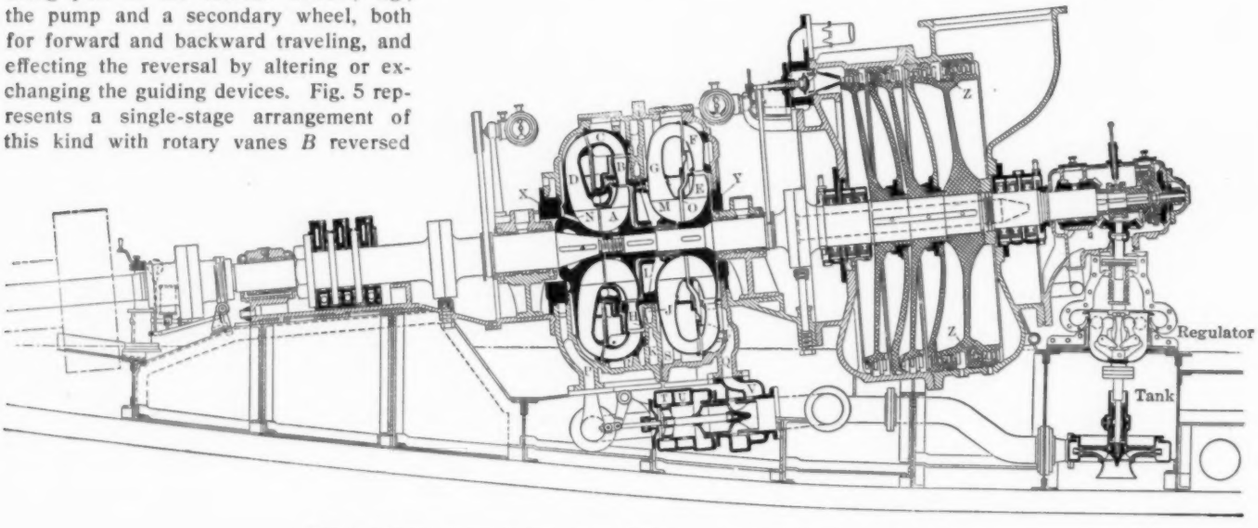


FIG. 9. CROSS-SECTION THROUGH 500-HORSEPOWER TURBINE PLANT

ly, with 180 horsepower, 83 per cent. There seems to be a tendency for a further slow increase.

Tests made on the backward cycle further showed a maximum efficiency of 70 per cent., so that even with a single-stage cycle a backward efficiency of about $70 \div 83 = 85$ per cent. of the primary efficiency with constant primary outputs, i. e., constant outputs of the steam turbine and boiler, is reached.

On account of these excellent results obtained with the very first experimental model, the manager of the Vulcan shipyards decided on immediately equipping with this model a small experimental vessel built especially for the purpose, in order to be in a position to demonstrate in actual operation the principle underlying the new drive.

As no efficient steam turbine can be designed for an output of only 100 horsepower with 1000 revolutions per minute, they made up their minds to increase the number of turns to about 1750, thus raising the output from 100 to 500 horsepower, the output being proportional to the cube of the number of turns. Because of the small first cost, a pure Curtis turbine was chosen as driving motor.

This plant was installed on board a 96-foot boat in actual service. Steering is effected in a surprisingly rapid and reliable manner. If, in case of a forced course, the steering lever of the slide be turned over from "forward" to "backward," while the steam turbine continues operating in the same direction, the secondary shaft can be stopped within 4 to 5 seconds, and will reach a backward speed of 200 to 250 revolutions per minute after a further 10 seconds. The remarkable backward efficiency of 85 per cent. can be maintained for any length of time, without any drop in boiler pressure.

Many modifications and combinations with combined reciprocating and turbine units are possible, and considerable planning has been done toward their use in merchant and war vessels.

Speculating in Machine Tools

By Frank C. Hudson

When a man wants a machine on the spot and has to wait months for it, he is forced into speculating on future needs, by the builder.

In such cases there may be a reason for his demanding cancelation before the machine can be delivered.

There is another side to the question of canceling orders that many seem to overlook, and that is the side of the real, legitimate buyer who wants a gear cutter or a grinding machine, wants it badly right this minute, and who cannot get a delivery until three months after next Christmas.

If he could buy the machine this minute he would be mighty glad to pay a premium so he could get it at work and begin to eat a hole in his accumulating work. Incidentally he would be saving money using it, or making a profit, just as you choose to put it.

In such a case he is not speculating on his own account, but is forced to take a chance on futures because the builder cannot fill his orders. He orders a machine to be delivered as soon as possible, hoping and believing that he may need it at that time. But not being a wizard or having a direct wire to Oyster Bay, he does not know that he will not be running half time, and hustling for work by the time the machine is ready. The cancelation clause is his only safeguard and he is not likely to give it up without a struggle.

There is another type of customer who is differently situated. He expects to need a new machine in a few months and so takes a chance, at the builder's expense, knowing that he can cancel the order at any time before the machine is actually shipped.

The no-cancelation clause would keep him out of the game and force him into the other class of not ordering until he actually needed the machine. And then he would join the waiting list.

It sometimes happens that a shop manager decides to enlarge his plant at a time when the land he wishes will not be available for several months. In such a case he may get an option on the land, making a deposit which is forfeited if he does not complete the bargain before the option expires.

Or it may happen that his decision to enlarge may hinge on a large order which he hopes or expects to land in the near future. The option on the land protects him in either case and, if he fails to secure the expected order he may be very glad to let the option money go by default, instead of buying at that time.

The man who expects to need a machine later is in a similar position and should be perfectly willing to pay for the chance of getting one when he needs it. If he guesses wrong and does not need it, he should be game enough to lose his option the same as he would in the case of a piece of land.

Many machine salesmen who have to make a showing in order to please some short-sighted manager take anything which bears the slightest resemblance to an order. Cancelations count for very little with them, as in the meantime their books are full of other orders—many of which will suffer the same fate.

Orders of this kind, very often urged by salesmen against the buyer's better judgment, are perhaps responsible for most of the trouble over cancelations. Many of them are given with only one chance in ten of their going through.

But in good times the salesman feels pretty sure that he can place the machine elsewhere and all is well until a slump bumps into us. Then everyone gets scared, cancelations come in with every mail and builders get a sort of dazed feeling and wonder where they are at.

The indiscriminate cancelation is distinctly bad. The speculator in future needs should be willing to pay for his option. But the man who would be glad to pay cash for a machine this minute and is forced to take chances on needing the machine when he can get it, is the one who needs consideration.

Some builders I know of seem to take delight in saying they are months behind with orders and don't seem to think business is good unless they are. But if I were building machines I should much rather be able to give a man what he wanted out of stock. There could be no question of cancelation then and I should not be forcing him to speculate. One builder I know always tries to keep machines on hand, even when others let things slide along. It ties up money, of course, which is often a serious consideration, but it has many advantages.

If someone will devise a way whereby builders of standard machines can keep at work during a slump, without bankrupting themselves with interest charges on borrowed money, there ought to be less trouble about deliveries in boom times. In fact, there would not be any boom or slump either. But as my financial operations are mostly confined to scraping up the cost for the boarding misses, I shall have to leave this end of the game to some of my Wall Street friends.

Device for Feeding Tacks

A reader would like to know if any of our correspondents or subscribers can describe a cheap or effective device, not patented, for feeding tacks about ½-inch long with flat head. These tacks should be fed automatically, either into a hole already punched for their entering, or on very thin metal that the tacks may do their own perforating. The speed should be about 150 per minute, three tacks at each revolution.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print is good enough to pay for. The value is in the idea—not the length of the letter.

A Thread Milling Attachment for an Engine Lathe

Having a large quantity of square thread screws to cut, we designed a thread-milling attachment for use on an ordinary 18-inch center engine lathe, as shown at Fig. 1, which shows the lathe minus the tailstock but which is used in the ordinary way. Fig. 2 shows a plan of the attachment removed from the carriage, and Fig. 3 is an elevation of the work spindle.

Referring to Fig. 1, *A* is a bracket which is planed to fit the cross slide. The vertical rib shown at *A'* in Fig. 3 is faced with a central locating recess to allow the casting *B* to bolt to it. *C C* are two brackets cast solid on *B*, bored to carry the steel-cutter spindle, shown also in Fig. 3. *D D* are two clamping studs screwed into *B*, passing through slots cored in *A*, which allows *B* to swivel to get the correct angle of cutter to suit the thread to be cut. Two nuts *D* secure the swivel as shown. *E* is a spiral gear, which gears in with and drives a similar gear *F* keyed on the cutter spindle. *E* is keyed on a short shaft which fits in a bearing in *A* as shown. The opposite end of this shaft carries a bevel wheel *G*, which is in turn driven by a larger bevel gear *H* (this is shown somewhat small in the illustration.) *I* is a bearing cast solid on *A*. It carries the end of the shaft carrying *G*, and also the shaft at right angles carrying *H*. *J* is a journal carrying the opposite end of the driving shaft, which is cast solid on *A* likewise, as shown in Fig. 1. *L* shows the thread-milling cutter. Fig. 2 shows the cutter spindle in a horizontal position. *K* is the driving pulley.

The cone pulleys of the lathe are not used for driving purposes when the thread-milling attachment is in use. A driving chain *M*, driven by the sprocket wheel *N* on the end of the countershaft *R*, drives the lathe by a much larger sprocket *O*, keyed on a sleeve, and driving the lathe main spindle very slowly through the back gearing. *P P* shows the countershaft bearings. The drum *Q* drives the pulley *K* by a belt in the usual way, regardless of the position of the carriage.

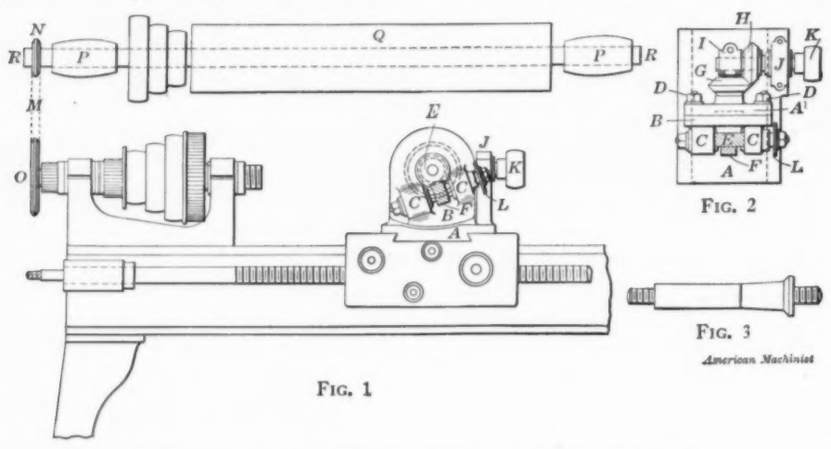


FIG. 1

FIG. 2

FIG. 3

A THREAD-MILLING ATTACHMENT FOR AN ENGINE LATHE

We recently added an automatic trip to the carriage whereby the cutter is automatically stopped when it gets to the end of its work, by throwing the overhead driving belt on to the loose pulley. This is not shown in the illustrations.

The cutter travels toward the tailstock, revolving at a high rate of speed, while the work revolves slowly. The carriage carrying the attachment is traversed by the lead screw in the usual way. The lathe we use is upward of 20 years old but turns out first-class threads at one cut, in a fraction of the time taken by the old method of cutting with a single-pointed tool. There is considerable end thrust on the cutter spindle, so it is made with two tapers of 45 degrees and 2½ degrees, as shown in Fig. 3, to take the end thrust.

A slight improvement may be made by making the driving pulley *K* a double flanged one instead of as shown, as sometimes when we are returning the saddle quickly by hand, the belt is apt to come off the pulley.

H. ANSLEY DALE.

Manchester, England.

An Efficient Parting Tool

The linecuts show the method we used recently in cutting up some steel plates, 3 feet square by 1¼ inches thick, into strips 6 inches wide. This work was done on an ordinary planer and we started out by using the regular parting tool, but it was not a success.

We could only take a light feed and when the tool reached about half the depth of the plate it would naturally clog up and break. As we had a great many of these plates to cut up, the outlook was rather discouraging. Finally, however, we hit upon a plan that worked out very successfully, and we feel that a great many others who have been up

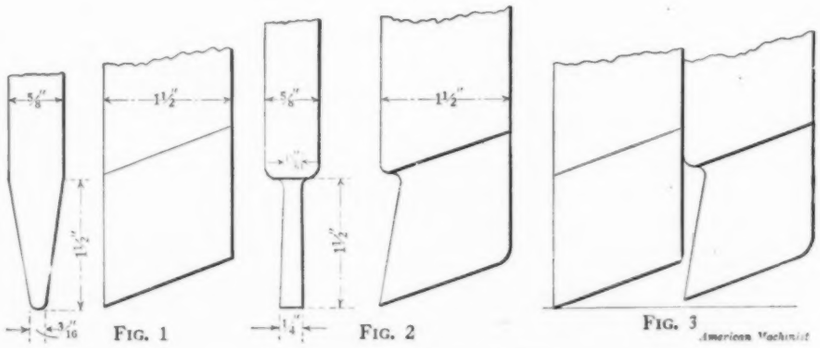


FIG. 1 FIG. 2 FIG. 3

AN EFFICIENT PARTING TOOL

against a similar proposition might be interested to learn how we got around it.

We forged up a tool of the shape shown in Fig. 1 of Rex steel and one of the same steel, as shown in Fig. 2. We then placed both tools in the same tool post, the tool shown in Fig. 1 being ahead of the tool shown in Fig. 2. Fig. 1 tool was also placed about 3/32 inch lower than the tool, Fig. 2; all as shown in Fig. 3.

The first tool took the brunt of the work and broke the chip for the tool in the rear. The results were most gratifying. We ran through a whole lot of these plates at a cutting speed of 30 to 35 feet per minute, and a feed of 3/64 inch without breaking a tool.

Bridgeport, Conn. S. M. W.

Machining Phosphor Bronze Boxes and Caps for Large Marine Type Connecting Rod

Having noted from time to time the ingenious jigs, fixtures and devices, described in the AMERICAN MACHINIST, for reducing the labor costs on various machine and fitting operations, I often think that the standard of intelligence of the workman using these is not as high as that of the old-time fitter and turner, who possessed a very high degree of skill. In marine-engine building, the old-fashioned type of craftsman still exists, and has to work without many special fixtures or jigs. On large work a great amount of time can be lost by not handling work to the best advantage. On these heavy operations the "feed and speed expert," and "ratefixer" generally get the worst of it as the job depends upon the skill of the workman alone. The job described herewith may be said to be a typical example of heavy work, entirely performed by standard tools, without special fixtures.

The first operation is to machine the phosphor-bronze half brass across the faces marked *A*, in Fig. 1. Two satisfactory methods present themselves, planing and milling on a vertical-spindle machine, with a large inserted blade cutter. The latter are expensive tools and the upkeep is great, so we choose planing.

The half brasses are secured to the planer table by two clamps as shown. The top face is machined up true, then the castings are turned over and the joints planed to size, care being taken to see

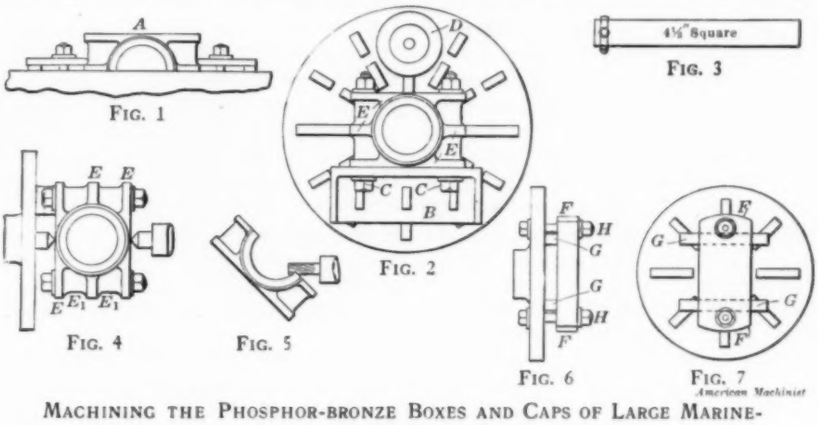


FIG. 1 FIG. 2 FIG. 3 FIG. 4 FIG. 5 FIG. 6 FIG. 7

American Machinist

MACHINING THE PHOSPHOR-BRONZE BOXES AND CAPS OF LARGE MARINE-TYPE CONNECTING RODS

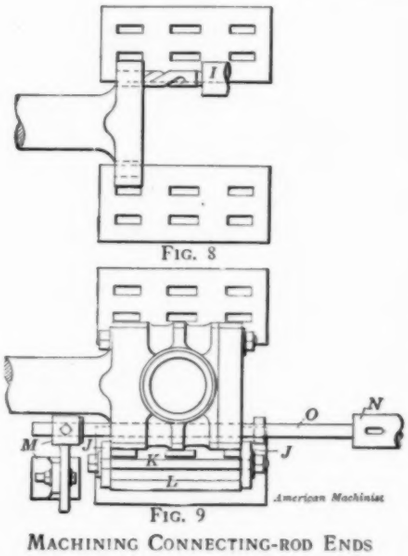


FIG. 8 FIG. 9

MACHINING CONNECTING-ROD ENDS

that they will bore to size when assembled. The joints are now bedded together by a fitter (they are still required in the heavy-engine trade). When a good fit has been obtained they are mounted on the angle plate *B*, which is secured to a large lathe faceplate, as shown in Fig. 2. The two bolts *C* pass through the cored holes, and secure them in position about two inches from the faceplate, to allow the boring bar, Fig. 3, to pass clear through. *D* is a balance weight secured to the faceplate. The brasses are now bored to size with the boring bar held in the slide rest. The front is faced, the edges rounded on the inside, and the ribs *E* faced to width. The brasses are then turned around, pushed up against the faceplate, and finished on the other side. They are then mounted between lathe centers as shown in Fig. 4, and the tops of the ribs *E* are turned to size and also the spaces between *E* 1, to give a finished appearance.

The supply of oil in liberal quantities to the crank-pin journal of a connecting rod is of paramount importance; hence the need for large oil spaces, which we mill, as shown at Fig. 5. For this operation the half brasses are secured to an angle plate on the milling-machine table, and milled across the joints as shown.

The forged-steel end cap, shown in Figs. 6 and 7, is first planed to thickness and width. The two bolt holes are marked off and drilled. The cap is then secured to a lathe faceplate as shown, and turned to diameter over *F*. *G* are two parallel strips, and *H* are the two bolts for holding the work in position.

The cap should now be scraped to a good fit on the end of the cap *A* by the fitter. Fig. 8 shows the connecting-rod end in position for rough drilling the bolt holes for the boring bar, shown at Fig. 9. These holes are 3¼ inches in diameter when finished. Fig. 9 shows the brasses and cap in position for boring the bolt holes. *J* are two clamps held by the bolt *K* and packing piece *L*. These secure one side, while the hole is being bored by the bar *O* in the spindle *N*. The cutter is shown in position in the bar, the outside end of which is supported in the steady *M*. A bolt inserted in the opposite holes holds the cap and brasses secure on the rod end. When the holes are bored the front cap is recessed to allow the spigot on the nut to enter it about ¼ inch. The bar is then reversed and a left-hand cutter inserted, and the T-end of the rod is recessed like the cap to allow the bolt head to enter in a similar manner. A snug bolt is then inserted in the finished hole and the other hole finished.

S. LAURANCE.

London, England.

Gear Cutting on a Keyseater

With the permission of Messrs. D. Milne & Sons, engineers, Aberdeen, Scot-

GEAR CUTTING ON A KEYSEATER

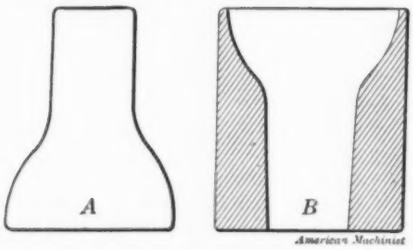
land, I have taken a photo of their No. 4 giant key seater cutting a gear as shown in the halftone. The wheel being cut is 42 inches diameter, 5 inches face, 1⅜ inches pitch and has 92 teeth. There is a division plate under the wheel and a clamp for holding the wheel tightly. The firm has a number of these wheels to cut and I generally do them and the time taken from start to finish is about eight hours. The teeth are first roughed out with a square cutter then finished with a formed cutter. With a few alterations I think I could cut the time in half.

DOUGLAS MILNE.

Aberdeen, Scotland.

A Lead "Tup" for Machine Hands

Our machine hands are all supplied with lead "tups" as shown at *A* in the linecut. At *B* is shown the cast-iron mold.



LEAD "TUP" AND MOLD

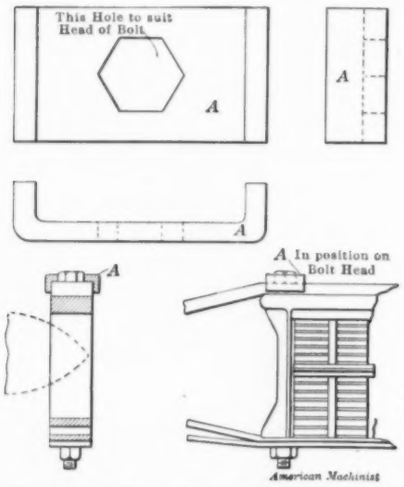
The "tups" will not mark finished work and when battered out of shape they still contain sufficient material to make a new one.

Manchester, England. A. P.

A Head Holder for Tender Truck Bolts

The line cut shows a simple method of holding tender-truck bolts from turning while assembling or dismantling tender trucks. The bolt holder *A* is simply a piece of iron with a hole punched in it to fit the various sized bolt heads. It is then lipped over to fit the arch bars. It holds the bolts from turning when strain is applied to the nut. It soon pays for itself and will be appreciated by those doing this class of work.

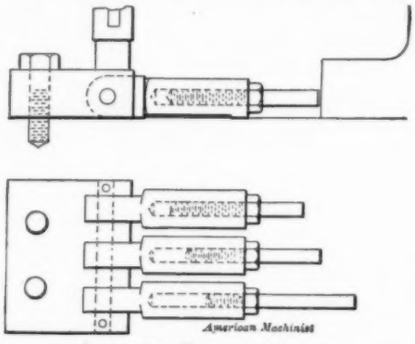
Chicago, Ill. W. J. SHADLE.



DEVICE TO KEEP BOLTS FROM TURNING

Stop for Engine Lathes

The accompanying illustration shows a handy attachment which will assist in producing duplicate parts on the engine lathe. It may be fastened on the ways



STOP FOR ENGINE LATHE

in front of lathe, for carriage on its longgitudinal travel, or on the cross carriage to reproduce a given diameter, or diameters. The feed, of course, must be thrown out on the longitudinal travel, as the carriage approaches the stop, the balance of the cut being taken by hand until the stop is reached. In the accompanying illustration there are three stops shown, but there is no reason why this number cannot be increased as desired. Naturally, the stop which is in a horizontal position is the one to be used, the other two are raised so that they cannot come in contact with the carriage.

Machine Grinding Cock Plugs

While there are a number of machines designed for the above purpose, many people are not familiar with their operation. The following is a brief description

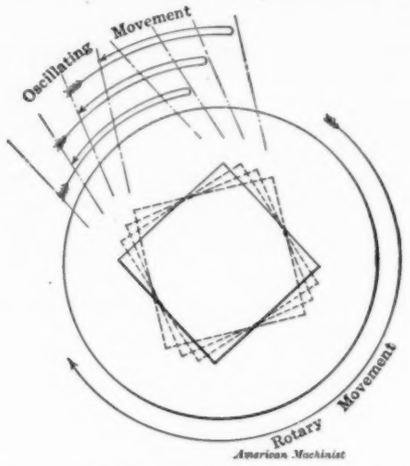


FIG. 1. END VIEW OF COCK PLUG, ILLUSTRATING GRINDING MOVEMENTS

of one of several like machines doing satisfactory work at the factory of one of the largest valve manufacturers in the country for a number of years. The operation is interesting from the fact that there are three distinct movements to be considered at the same time.

First there is the oscillating movement of the plug; this alone is not sufficient to insure a correct seating, consequently it has to be accompanied by a rotary movement which, although independent of the oscillation, is in action at the same time. While the plug is going through its evolutions a reciprocating motion is also imparted to the cock body. Fig. 1 should make this explanation clear regarding the

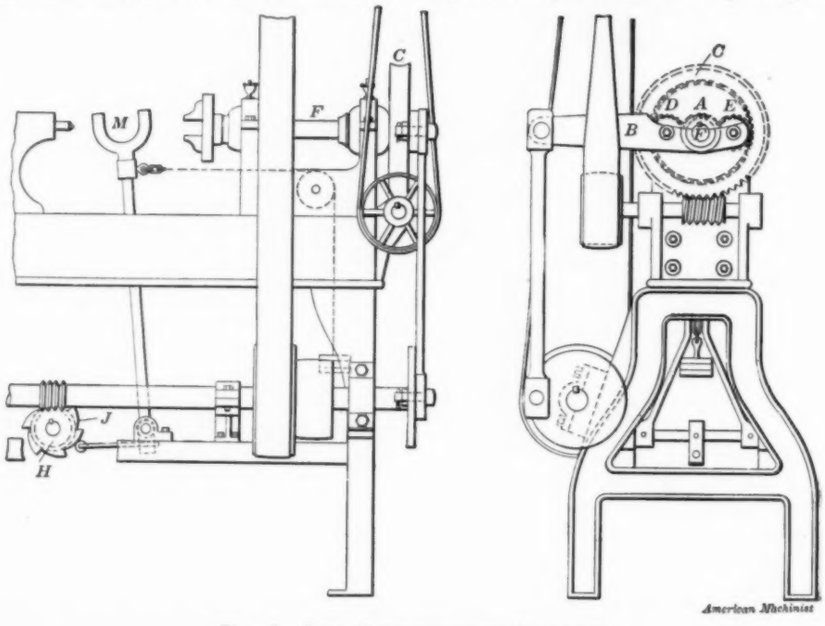


FIG. 2. THE COCK-GRINDING MACHINE

movements of the plug. Fig. 2 shows how the movements are obtained. For simplicity a single spindle is shown, although a similar principle is applied to multiple-spindle machines.

It will be seen that an oscillating movement is imparted to the spindle *F* by the arm *B* through the gears *D* and *E*, which are both in mesh with the internally geared worm wheel *C* and the gear *A*. This gear *A* is keyed to the spindle but the arm *B* is free; the worm wheel *C* also acting through the gears *D* and *E* causes the rotation. The plug is caught in the chuck and centered on the back stop, while the body rests in the holder *M*. The reciprocating movement is imparted to *M* through the ratchet wheel *J* which is on the same spindle as the worm wheel *H*.

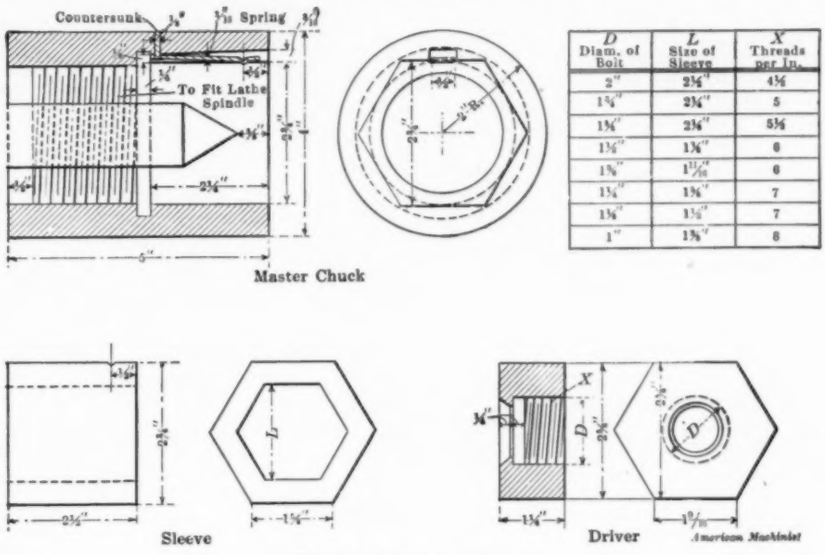
As stated, this type of machine has been in use a good many years, but is still doing satisfactory work. The mechanical principles involved in the machine are not easy to follow, but by a little careful study the movement of the gear wheels may be followed.

Boston, Mass. F. GARRETT.

A Bolt Chuck and a Staybolt Chuck

The bolt chuck shown in Fig. 1 saves practically all the time of chucking the bolts as it is only necessary to slip the proper size sleeve in the master chuck, and then place the head of each bolt in turn in the sleeve. The master chuck, of course, remains in the lathe continually, and is intended for use on lathes which are used for bolt work most of the time.

The staybolt chuck, Fig. 2, eliminates the necessity of squaring the ends of the staybolts in order to drive them. This chuck grips either the round or the threaded part of the bolt, so that when the threads are run the full length of a rod, and then the rod is cut up into staybolts, they can be driven without further work. A slight backward movement instantly releases the chuck so that it can be removed from the bolt. As shown in the drawing, the parts of this chuck are easily removable for repairs or replacement.



D Diam. of Bolt	*L* Size of Sleeve	*X* Threads per In.
2″	2¼″	4½
1¾″	2¼″	5
1½″	2¼″	5½
1⅜″	1¾″	6
1¼″	1 11/16″	6
1⅛″	1⅜″	7
1⅛″	1⅛″	7
1″	1⅜″	8

FIG. 1. A BOLT CHUCK

The body *A* is made of machinery steel, bored and recessed at *D* for the hardened tool-steel wedge *C*. The cap *B* is made of tool steel.

New York. C. J. MORRISON.

Homemade Drafting Table

The student or the busy man who has occasion to make drawings at home has experienced the inconvenience of using the ordinary drafting board by laying it upon a table or what not, and as most of us cannot afford, or do not wish to burden ourselves with the usually bulky tables made for drafting office use, I thought some might appreciate a few sketches of a light, simple and inexpensive table that I made and have used with entire satisfaction for quite a while.

I did not consider it expedient to make the board myself, purchasing one of the desired size (23x31). The legs were made

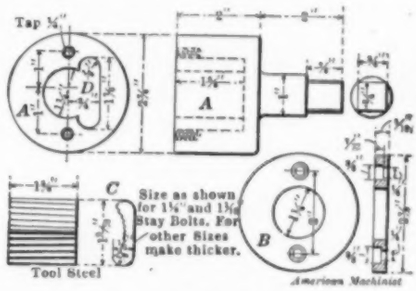
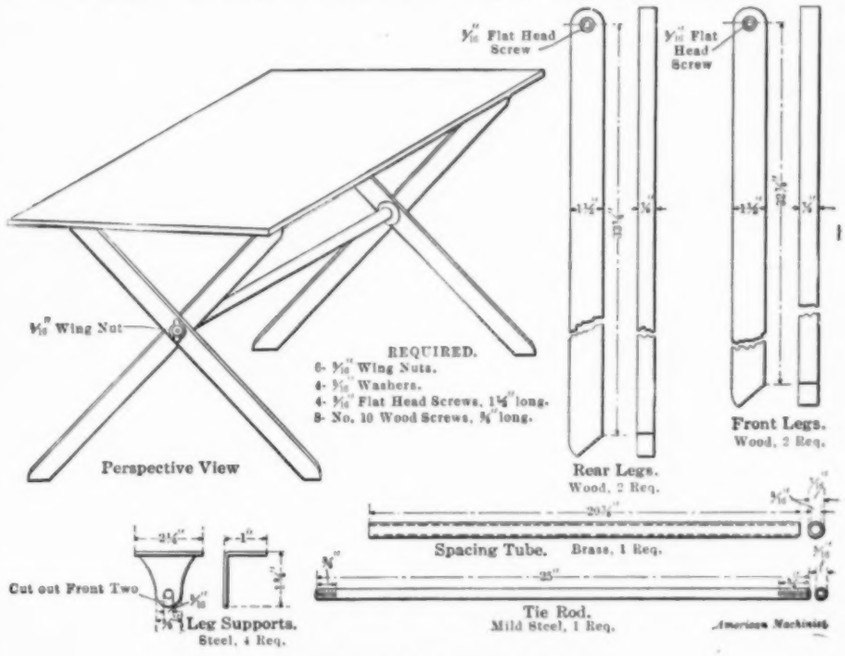


FIG. 2. A STAYBOLT CHUCK

of planed hardwood and were varnished. The rear ones, that is, those extending from the rear to the front, are longer so as to give the desired forward slant to the board. They are secured to the board by supports, which as shown in the drawing are No. 16 gage plates, filed to shape and bent at right angles; those for the rear legs having 5/16-inch holes, those for the front 5/16-inch slots through which pass 5/16-inch flat-head machine screws with wing nuts. The supports are screwed to the board by No. 10 wood screws, which must be short enough not to come through top of board. Five-sixteenth-inch holes are bored through the legs where they intersect and a 5/16-



A HOMEMADE DRAFTING TABLE

inch steel tie-rod which is passed through a brass spacing-tube and has wing nuts on the outside, draws the legs together and clamps them securely. Five-sixteenth-inch washers are used on the rod to face the inside and outside of the legs.

When it is desired to ship or move the table, it may easily be "knocked down" by removing the six wing nuts; making a neat package of the whole affair. When it is desired to set the table away so that it will occupy small space, or it is desired to carry it short distances, all that is necessary is to loosen the wing nuts clamping front legs to front-leg supports, and tie-rod nuts, when the bolt may be slipped out of the 5/16-inch slots, and table partly folded.

It may be supposed that this table would be wabbly or unsubstantial, but this inference is not correct. While not so rigid as those having a heavy or complicated supporting frame, it has never given trouble from lack of rigidity.

The dimensions for legs give a hight of 25½ inches and 27 inches, respectively, for front and back of board from floor. To make it higher, or lower, the holes for the tie-rod should be bored lower, or higher, as the case may be.

Such a table makes it a pleasure to work out some of those ideas which lack of facilities often postpones indefinitely.

Chicago, Ill. ARTHUR F. KUNZE.

Shaft Ends, Keys and Key Guards

If the end of a shaft be faced flat and the corners rounded, as shown in Fig. 1, this part of the shaft will present a neater finish than it would if the end were simply crowned. The tables given in connection with the drawing give the radii of the rounded corners, projection of shafts, etc., which I use. Fig. 1 shows the end of the shaft projecting through its bearing without gear or other detail. In such a case the projection as given in the table is a little greater than the radius of the corner. The object in this is to obviate the necessity for exactness in facing the shaft to length.

In the case of a gear or other detail keyed to the end of the shaft, the shaft should project beyond the outer end of the key, as shown in Fig. 2. When thus made, the shaft will support a head-key when the latter is being driven out by the head and at the same time it will serve as a partial protection against the danger of the clothing being caught by the key when the shaft is in motion. However, the latter object may be better attained by using a collar which completely covers the key as shown in Fig. 3. This collar is cast with a recess or groove amply large to clear the key, and it is held by a headless set-screw. I have seen collars somewhat similar on printing presses, but held by a screw tapped into the center upon which the shaft had been machined. This is bad practice, as the shaft centers should be kept in good condition in order that the bearings on the shaft may be at any time re-turned without the necessity of re-centering the shaft.

The matter of protecting workmen from revolving gears, keys, etc., receives more attention at the present time than formerly. In many cases it is just as well to make the gear-guard of such shape as will cover the end of the shaft and key as well as the gear teeth.

W. S. LEONARD.

Atlanta, Ga.

Radii of Corners of Shafts								
Diameters		under	½″	= 1/32″	Rad.	(A).	B = 1/16″
½″	" and	"	1″	= 1/16″	"	"	" = 3/32″
1″	" "	"	1½″	= 3/32″	"	"	" = 1/8″
1½″	" "	"	2″	= 1/8″	"	"	" = 5/32″
2″	" "	"	2½″	= 5/32″	"	"	" = 3/16″
2½″	" "	"	3″	= 3/16″	"	"	" = 7/32″

Projections of Shafts on Account of Keys.					
Width of Key			1/4″	Projection	(C) = 5/8″
"	"	"	3/8″	"	" = 3/4″
"	"	"	1/2″	"	" = 7/8″
"	"	"	5/8″	"	" = 1″
"	"	"	3/4″	"	" = 1 1/8″

General Rules for Width of Keys.						
Diam. of Shaft			3/4″	and under	1 1/4″	= 1/4″
"	"	"	1 1/4″	"	1 3/4″	= 5/16″
"	"	"	1 3/4″	"	2 1/4″	= 1/2″
"	"	"	2 1/4″	"	2 3/4″	= 5/8″
"	"	"	2 3/4″	"	3 1/4″	= 3/4″

SHAFT ENDS AND KEYS

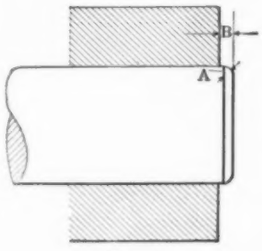


FIG. 1

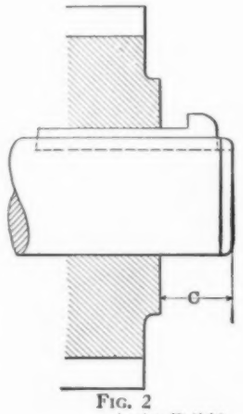


FIG. 2
American Machinist

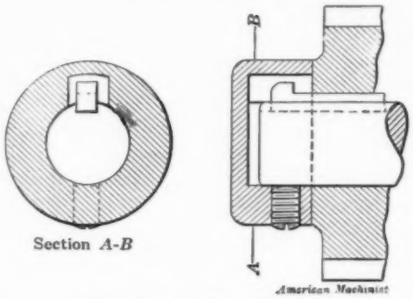
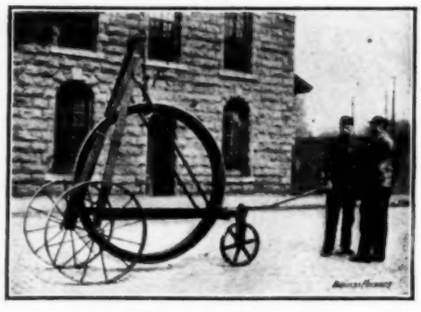


FIG. 3. A KEY GUARD

A Simple Tire Carrier

The illustration shows a three-wheeled cart which is used to handle driving-wheel tires, from the smallest, 42 inches, up to 74 inches in diameter. After tire is in place, three men can take a 74-inch tire from the tire rack to its place in the shop without any danger of accident and in one-half the time it takes for seven men to roll a 74-inch tire as we used to do before this cart was made.



SIMPLE TIRE CARRIER

To place tire in position on cart, roll tire in position, wrap chain around the tire and pull down on lever until it catches in a spring snap. This cart was suggested by machinist H. Harrison, who deserves credit for its simplicity and successful use.

CHARLES MARKEL,
Shop foreman, C. & N. W. Ry.
Clinton, Iowa.

Discussion of Previous Question

Are There Flats on Generated Gear Teeth?

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers.

Matter on gearing from the pen of George B. Grant is always interesting, and it naturally follows that his article on page 1148, Volume 33, Part 1, entitled "Why Gear Hobbing Machines Cut Flats," was read with the closest attention.

Having been a student of Mr. Grant on gearing matters for some years, I feel, when setting out to take a contrary view, somewhat in the same frame of mind that David must have felt when he set out

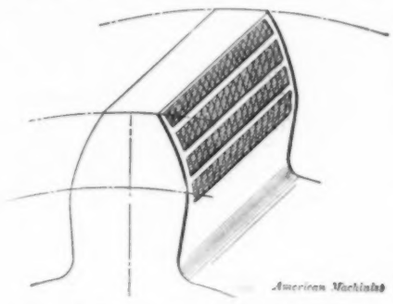


FIG. 1. CURVES ON HOBBED TEETH

to meet his gigantic opponent, armed with a sling and pebble only; and although there is no fear of an ending similar to that of the Biblical narrative, I trust the pebble will miss him, and, falling in the lake of gearing experience surrounding him, cause a splash from the ever-widening ripples of which I hope to glean some information on a too little discussed question.

Coming back to Mr. Grant's flats, I am not prepared to admit that such do exist, or if they do, to use an Irishism, they are not flats but curves that approximate somewhat to the true curve at any point.

When work has been unduly forced, or cut with a hob having one or two drunken teeth, or on a weak machine, then several of these curves may run into one another, giving the appearance of flats, which are, nevertheless, curves.

That these curves exist is beyond question, and I fear Mr. Grant has failed to diagnose the case correctly, and this is clearly proved if we take his example of the single tooth or fly cutter and analyze its movement. Mr. Grant in considering this point has not fully appreciated the effect of the relative movement between the fly cutter and the wheel blank, which, being accepted, we must also accept the fact that a straight line of any angle, revolving as this fly cutter does, must of necessity generate some sort of a curve in *passing through the work.*

Mr. Grant has considered the gear blank as being thin, and, if we only consider the action of the cutting tooth when in the vertical or horizontal plane (according to type of machine), then there would be a flat. But if we consider the gear blank as made up of many disks, then the fly cutter will cut, say, No. 1 disk when it is vertical and the horizontal projection of its cutting edge makes, say, 15 degrees with the vertical. In passing over the second disk the horizontal projection of the cutting edge will be 15 degrees + a small angle due to rotation of cutter, and similarly with disks 3, 4, 5, etc., the angle of cutting edge, projected horizontally, will for each successive position make a slightly larger angle. Therefore, if we take positions for equal angular increments of fly cutter, and positions for the equivalent angular increments of the tooth to be generated and plot them, we shall find we have a series of straight lines at various angles; consequently, if we take a sufficient number of points (given the necessary patience)

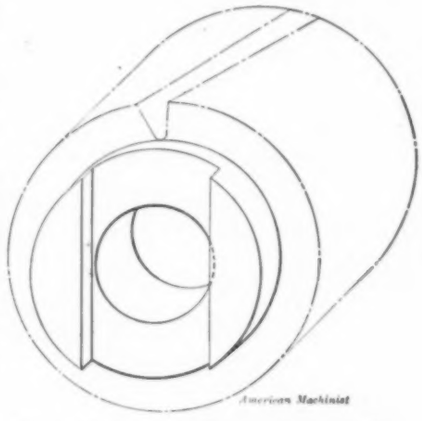


FIG. 4. PROPER METHOD OF DRIVING HOBS

we shall of course have a curve, and if we did the same with a hob we should have a separate curve between the limits of action of each tooth. That is, if we consider the case of a hob with one circle of, say, 10 teeth, we should get a series

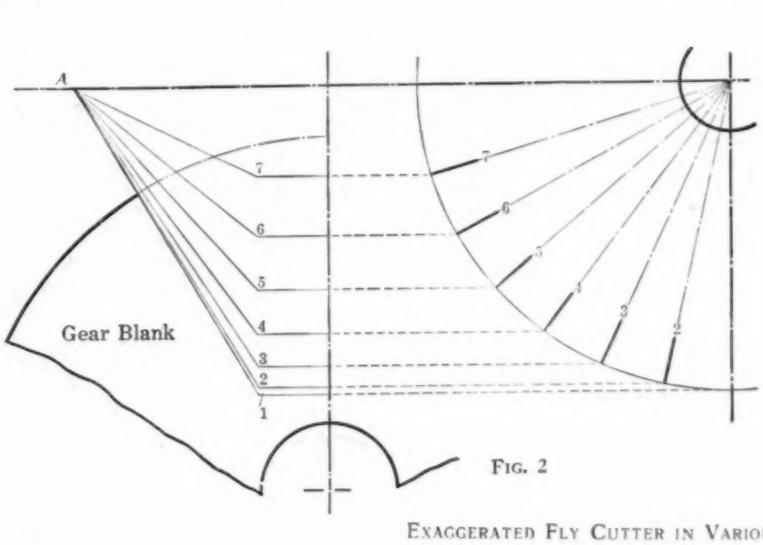


FIG. 2

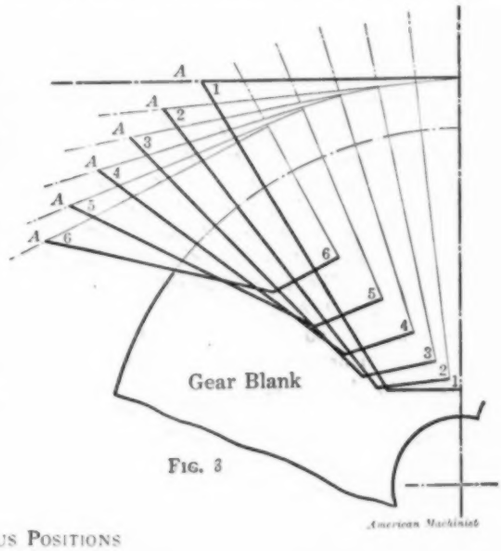


FIG. 3

EXAGGERATED FLY CUTTER IN VARIOUS POSITIONS

of 10 curves instead of, as suggested by Mr. Grant, 10 flats. These curves are roughly shown exaggerated in Fig. 1.

To prove that a fly cutter working through a gear (after the manner of a hob) will not produce a flat, Figs. 2 and 3 are given. In Fig. 2 a much exaggerated fly cutter is shown with the cutting edge produced to axis *A*, the various positions being projected from the right-hand side, and in this figure one clearly sees the difference in angle of the cutting edge as viewed in the direction of travel. Now as there is to be relative movement between the cutter and the wheel blank, it does not matter whether we rotate the blank on its axis or move the position of the cutter round the blank; therefore, for convenience, I have taken the projection of the fly cutter in the various numbered positions as shown in Fig. 2, and plotted them in their relative position in Fig. 3, which clearly shows the curve. The two figures may be easily followed by referring to the numbers. The seventh position, coming outside the blank, is not plotted in Fig. 3.

An interesting point to be noted in Fig. 3 is that the corner of the cutter in the second position is outside the cut taken in the first and similarly with third position, thus actually showing how the fillet at the root of tooth would be produced in this exaggerated case from a sharp corner.

Figs. 2 and 3, I think, clearly show that flats on generated gears are impossible, also that Mr. Grant's fly-cutter example is incorrect; but to those who are still skeptical, may I quote a passage from Mr. Grant's excellent treatise on gears, page 99, "But that it is wrong is clearly shown by the most convincing of all proofs, the reduction to practice."

There are, in my opinion, three principal reasons why spur gears generated from hobs are not always what they should be, and in stating them will place them in order of their relative importance.

(1) Worship at the shrine of the great god Output.

(2) Badly proportioned and inaccurately made hobs.

(3) Weak design in the machines.

The first came from a microbe that was hatched out by the makers of both hobs and machines, and, falling into suitable incubators, the germs have multiplied exceedingly. The cure is doubtful, but the microbe will be kept under by the modern demand for accuracy.

Numbers 2 and 3 will be improved by the usual process of evolution, a parallel case being cylindrical grinding, which the improvement of both wheels and machines has brought to its present condition.

Touching on the question of the hob, how many users of hobs ever think it is necessary to have a roughing and a finishing hob when accurate gears are required? Yet these same practical men would be amazed if it was suggested that they should finish, say, a gage in the lathe with one cut. Two hobs are a necessity when accurate work is required, and the finishing hob should do no work at the bottom; that is, the rougher should stock out to the full depth. The finishing hob should also have plenty of clearance on its teeth. This fault, lack of clearance, is fairly common and is the cause of many poor gears besides putting an undue strain on the machine.

The design of hobs presents more difficulties than are apparent at first sight, and the complete manufacture of a hob to do good work is an excellent test as to the capabilities of any tool room. Undoubtedly our tool makers could turn out a better hob than they do, but competition (another phase of the god Output) pushes them along.

The most potent cause of trouble with hobs, is, of course, the errors due to distortion in hardening, but these may be minimized to a considerable extent if the hob blank is treated as was suggested in a previous article, that is, roughed out all over, threads and gashes included, and then *hardened* and reannealed. But a further protection against warping in the hardening process is to do away with the keyway that usually passes through the hob and substitute plain parts on either end, which may be used for driving clutches, as shown diagrammatically in Fig. 4, the corresponding clutch being formed solid on the machine arbor. Hobs with clutches as shown have not, to the writer's knowledge, been marketed, but the German maker, J. E. Reinecker, uses a similar arrangement on taper hobs for worm wheels, the slot being in the hob proper, which is driven by a loose collar that has been patented. The plain ends, as suggested in Fig. 4, serve another useful purpose, as they are very helpful in setting the hob for grinding the hole, and only those who have run against this job personally can appreciate the difference of grinding with and without the extensions. Further, they are extremely useful for checking the hob on its arbor in the machine. These extensions mean more material, but they also insure a truer hob.

Before leaving the subject, it would be well to point out that there are several types of machines on the market that do produce gears by a series of flats; that is, there is no relative motion between the flat tool and the gear during the cutting stroke and, strange as it may appear, one of these is generally credited with turning off the best running gears. This being so, we must look to something other than the theory of hobbing to account for the noisy hobbed gears.

WALTER G. GROOCOCK.

Plumstead, England.

The Expert Operator

The incident related by "Expert Operator," at page 1123, Part 1, Volume 33, is no uncommon one, but is one that is easily avoided. The business of a demonstrator of any machine is one that requires some little tact, but the exercise of this has, of course, its limits.

I should say in this case he made a great mistake in ever attempting the trial until conditions were fit, and evidently allowed himself to be cajoled by some unreasonable individual at the expense of his employer's interest. I have myself been up against similar conditions at various times, but now invariably refuse to demonstrate unless all existing conditions are such as will give my employer's faith in me some justification.

A little knowledge is said to be a dangerous thing and some five years' experience as a demonstrator in a special line has convinced me that there is much truth in the phrase; it generally happens that those who require and demand to see these freak jobs have the least knowledge of mechanical principles or else are naturally cross-grained, and a little display of tact and firmness will usually bring them to reason.

Equally absurd are those clients, or their officials, who seem to have assumed that the expert or demonstrator has visited them for manufacturing purposes, and who, after the demonstrator has proved the truth of his employer's claim for his goods, seem to have a frantic desire to get as much extra work out of him as possible, rather than that he should teach the future operator of the machine to become as expert as himself. The result usually is that after he has left, the machine does not come up to its maximum guarantee and there is general dissatisfaction.

To obviate this somewhat, I have lately carried out a practice which I can recommend to my fellow demonstrators as saving them some future trouble and annoyance. In the case of each job of importance that I demonstrate I take graphic notes of all the circumstances which produce the desired output, and I bring my operating down to as nearly a purely mechanical process as possible. After I have finished and before I leave the premises I draw up a little schedule of operations, giving speeds, feeds, etc., and leave it with someone in authority who seems the most in earnest; the schedules are accompanied by a brief note which points out that if the same combination of feeds, speeds, etc., is obtained on the machines, the same output will be obtained so long as the combination is coupled with ordinary intelligence.

DEMONSTRATOR.

Coventry, England.

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American Machinist

Editorial

Occupational or Industrial Diseases

The machine-building trades are singularly free from the occupational diseases which attend such industries as match making and the manufactures into which lead enters to a marked degree. If we except the dust and grit from grinding operations they are very hard to find, and here the almost universal use of exhaust fans has reduced the discomfort and danger to a minimum.

But all progressive men are interested in the prevention of industrial diseases of all kinds, realizing that they are an economic loss as well as a reproach to our civilization and humanity.

The State of Illinois has a commission of nine members, who serve without pay, and an outline of their plans is given in publication No. 10 of the American Association for Labor Legislation. This also contains a report of the first national conference on industrial diseases and is a good thing to have handy for reference.

Options vs. No Cancelation Contracts

While all machine-tool builders are agreed that the evils attending indiscriminate cancelation of orders can hardly be overestimated, there is a feeling in some quarters that a strict enforcement of the no-cancelation clause would not be as desirable as it may appear.

If machines must be specially built for a customer there can be no question as to his duty in taking them when completed within the specified time. But when it is a standard machine and the delivery is delayed by the inability of the builder to supply, some feel that the case has a different aspect.

Bearing this in mind, the plan followed in the automobile trade, of partial payment with the order, which is a sort of option on a machine to be completed later, is being seriously considered in some quarters.

Some builders of machine tools feel that this would be accepted more readily by desirable customers than an iron-clad no-cancelation agreement. And if, as might often happen, the customer would rather lose his option than make the final payment, the builder would not be in as bad a position as at present when a lot of orders are canceled.

It might be considered as an option on a piece of property, which is a very common transaction, and is simply paying for the privilege of securing the machine at a specified time.

If customers were given the choice between paying a portion of the purchase price as an option and a no-cancelation contract, it would be very easy to determine which way was preferable to them.

The main thing to be discouraged is the speculating in future needs at the expense of the builders of machine tools and other machinery, and any plan which promises to do this should be carefully considered.

Shop Rules

Most shops have some rules. Some have them posted for everyone to read. Some do not. When a new man comes into the shop and sees a set of rules posted under a glass so dirty with age that he has to put on his specs to see them, he is apt to omit reading them at all, in which he is something like the small boy who looks at the ground while passing a trespass sign.

We question the value of the larger part of the rules posted. Hours on which the shop runs are hardly to be classed as rules, though it is common to see shops running on anything but the hours stated on the bulletin board. Rules relating to tobacco and drink usually depend on the state of business for their enforcement. When business is rushing and help is scarce a good workman can be out "sick" just after pay day with comparative impunity, and when the shop needs to run evenings it is next to impossible to enforce smoking rules if some of the best men see fit to break them.

Then there are the rules about wasting oil and waste, none of which have any effect, human nature being such that some men will save anyway and the rest will waste unless their supply is checked.

Out in the freight yard the trains have open to them not the choice of crossings, but just one path laid out by the master mind that sits in the tower. Up country where the freight yard consists of two sidings, the brakeman jumps off and opens his own switches. So in the shop the large shop should control the movements of its employees by leaving

open only one path. In the small shop each man may largely take his own course without rules, because the class of men who can be profitably employed in a small shop is such that they can be better controlled by example and individual admonishment and also because latitude is necessary. A man possessed of any considerable skill considers himself above any written laws and he also feels an independence which, except in times of business depression, makes the literal enforcement of fixed rules impossible.

In this connection it may be said that the increasing mobility of labor is a force to be reckoned with. Labor seeks its best market and, we believe, wisely. The steady job has two sides to it. If its nature is such that it means stagnation, it cannot be afforded until one is on the down-hill side of life, which does not begin at any definite age. Some men reach their limit at 30, while others rise as long as they live. Many men in accepting such a life job die a living death by leaving ambition behind and settling in a rut. The man who moves about, even if only under the same roof, sees something new to work for. He sees where one employer or one superintendent accomplishes more than another; he sees opportunity ahead for himself and even if it is disagreeable for an employer to have a moving population in his shop, it is to his advantage to get in new blood from other shops and other cities because of what he may learn.

New Publications

Henley's Encyclopedia of Practical Engineering and Allied Trades. Volume V. Four hundred and eighty 7x10-inch pages, with 508 illustrations. Edited by Joseph G. Horner. The Norman W. Henley Publishing Company, New York. Price, $6, or $25 for the set of five volumes.

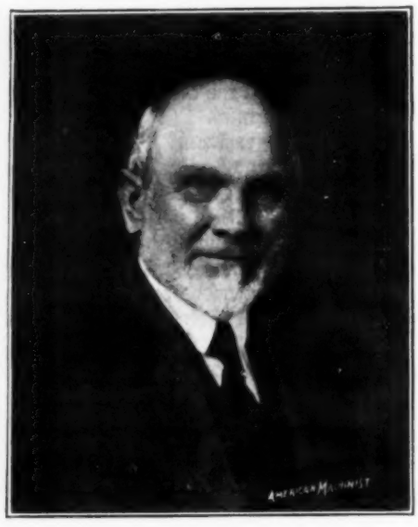
The present volume, which completes the encyclopedia, begins with Specific Density and ends with Zinc. The field of engineering is amply sufficient to justify the preparation of an encylcopedia covering it. This field is covered thoroughly and well, and both editor and publisher are to be congratulated on the completion of an arduous piece of work.

Practice and Theory of the Injector. By Strickland L. Kneass. Third edition revised and enlarged. One hundred and seventy-five 6x9-inch pages, with 53 illustrations. John Wiley & Sons, New York. Chapman & Hall, Ltd., London. Price, $1.50.

The fact that the third edition of this publication has been called for, although it is only about two years old, indicates plainly enough that it has met a real want. The book is a thoroughly scientific and equally satisfactory practical treatise upon its subject. The theory of the action of the injector is properly explained, while the results of large numbers of tests are given in both tables and diagrams. A sketch of the historical developments of the instrument is given, and the various standard constructions are given suitable and impartial consideration.

Sixty Years of Service

We rarely publish portraits, but we feel sure that our readers will be interested to see the genial face of Thomas Ogram, who, on July 23, completed his sixtieth year of continuous service with William Sellers & Co., of Philadelphia, Penn.



Thomas Ogram, for 60 Years with William Sellers & Co.

A broad testimonial, the text of which will follow, signed by the officers and staff as well as by directors who were formerly officers of the company, was presented to Mr. Ogram with appropriate remarks.

"To our dear comrade Thomas Ogram, greeting:

"This twenty-third day of July, 1910, brings to us the notable reminder that on the same day many years ago you entered the employ of this house as an apprentice, and have now completed an unbroken, faithful and honorable service of sixty years.

"It is accorded few men to attain such an enviable record, and fewer employers to receive such loyal service.

"In all of this long period as apprentice, journeyman machinist, foreman and trusty counselor and instructor of other apprentices, your varied and responsible duties were performed cheerfully and with exceptional skill, while the impress of your high character and genial personality was left upon all with whom you came in contact.

"Meanwhile, the number of our employees grew from thirty-five to nearly six hundred, and the product of the particular department with which you were most directly identified—metal planing and metal-planing machines—has acquired the highest reputation all over the world.

"It therefore seems to us fitting that we should especially commemorate this day by presenting to you with appreciative and affectionate greeting this inscribed testimonial as a permanent record of our high and lasting regard."

Among the men in the shop who greeted Mr. Ogram were many who had worked with him from 5 to 40 years, not continuously in all cases, but at different periods.

Such evidence of personal interest and confidence between employers and their men should do much to counteract the idea that they no longer have a place in the larger shops.

Obituary

We regret to record the death of Otis H. Childs, president of the United Engineering and Foundry Company, of Pittsburg, Penn., on August 2. Mr. Childs died of apoplexy at Cleveland, O., where he had gone for special medical treatment. He was considered one of the most practical men in the country in his particular line.

Personals*

M. M. Case, until recently mechanical engineer of the Champion Machinery Company, Joliet, Ill., has been made its superintendent.

A. Lebrecht, formerly of New York City, is now consulting engineer at Hefnersplatz 3, and Bayrentherstrasse 22, Nuremberg, Germany.

William F. Slower, of the Fellows Gear Shaper Company, Springfield, Vt., is now located at 61 West Panfield avenue, Detroit, Mich., for the same company.

George R. Bennett, formerly with McDowell, Stocker & Co., has resigned to become identified with Edgar Allen & Co., Ltd., with headquarters in Chicago.

Arthur F. Pitkin, of the automobile department of the American Locomotive Company, at Providence, R. I., leaves that company on September 1, to become assistant to John Riddell, mechanical superintendent of the General Electric Company.

Dr. W. H. Tolman, director of the American Museum of Safety, has been designated by the State Department as a delegate on the part of the United States to the International Congress on Workman's Insurance to be held at The Hague, September 6 to 9.

*Items for this column are solicited.

New Tools and Shop Appliances

New Cincinnati Bickford Radial

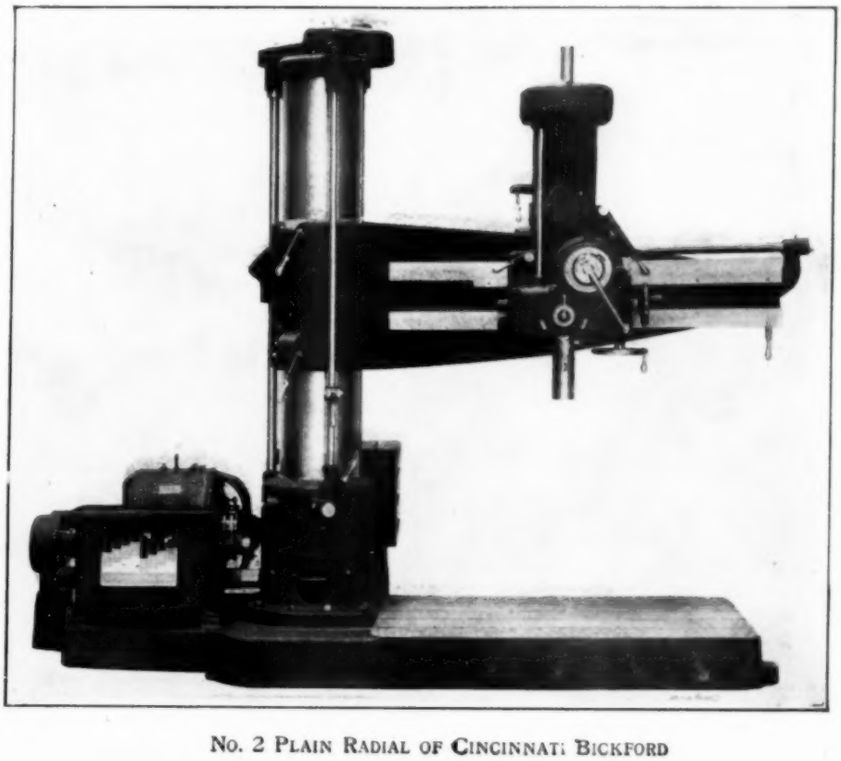
The illustration shows the No. 2 plain radial drill of a new line designed by the Cincinnati Bickford Tool Company, Cincinnati, Ohio. This is equipped with a 7½-horsepower constant-speed motor which, in combination with the gear box shown, gives 24 different spindle speeds. When equipped with a cone there are 15 speed changes. The speed range is from 21 to 306 revolutions per minute in correct ratios for securing approximately 35 feet cutting speed on all diameters for drills from 7/16 to 6¼ inches. This, of course, allows a much higher speed through a smaller range of drill sizes. In operating the gear box, it is only necessary to toss the lever from one notch to the next, as the tumbler gear falls readily into place.

There are eight feeds ranging from 0.006 to 0.030 in. per revolution of the spindle, each of which is instantly available. The back gears are in the head and furnish three changes of speed, each set being capable of transmitting 2½ times the pulling power of the next faster one. Gears are completely incased, and are so designed that their periphery speed never exceeds 1000 feet per minute. The arm lowers at double its elevating speed. The column extends to the top of the sleeve, is internally ribbed and has two ball bearings, one carrying the weight and the other the side pressure of the swinging members.

This machine has a 14-inch column, having a total hight of 9 feet, 4⅝ inches from the floor, and is made with arms of 4, 5 and 6 feet. The working surface of the base is 42x51½ inches and of the table 21x28 inches.

ANY and all new or improved machines, tools, or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here—the machine shop news.

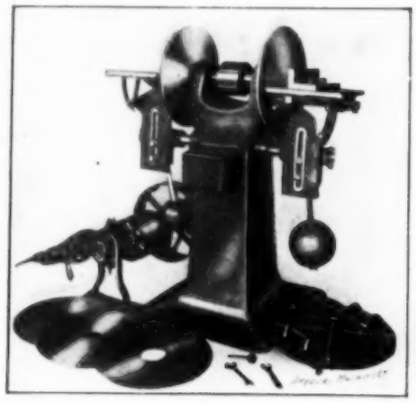
A more full and detailed description will be given—when it is real news—if it can appear here first—before it is sent to other papers. All descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German.



No. 2 Plain Radial of Cincinnati Bickford

A Double Disk Grinder

The halftone shows a new double-disk grinder which has been brought out by the Rowbottom Machine Company, Waterville, Conn.

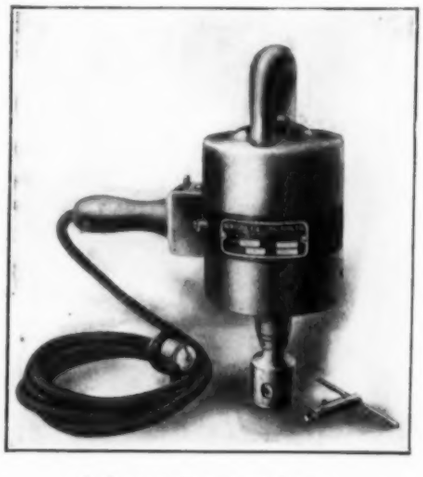


A Double Disk Grinder

The rests are of the swinging type and the tables can be set at any angle. The equipment includes a countershaft and cementing clamp for renewing the grinding disk.

A Small Electric Drill

The illustration shows a very small electric drill, made by the New York Electric Tool Company, New York City, and having a capacity of one-quarter inch in steel, or one-half inch in wood. Its

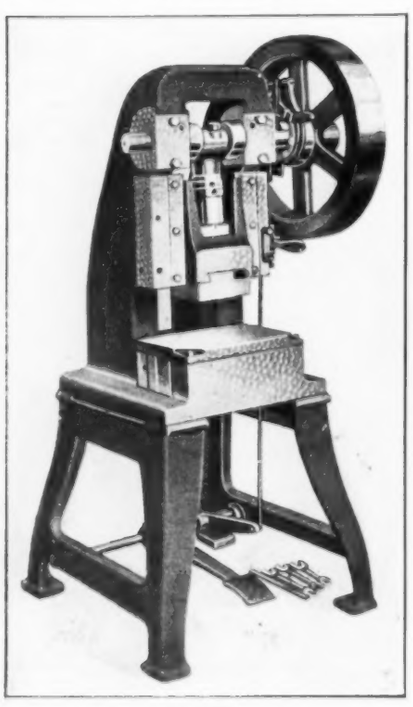


A Small Electric Drill

normal speed is 1000 revolutions per minute, it is 4 inches in diameter and 10½ inches high, weighing only 6½ pounds. It has been made very light in order to handle easily, which makes it very convenient for many classes of light work. It is equipped with 8 feet of flexible, twin conductor and a special quickly detachable plug for obtaining currents at the most convenient point. It is built along similar lines to the larger drills of this company which were recently described.

Open Back Power Press

The halftone shows an open-back press recently put up by the Baird Machine Company, Oakville, Conn.



A Power Press

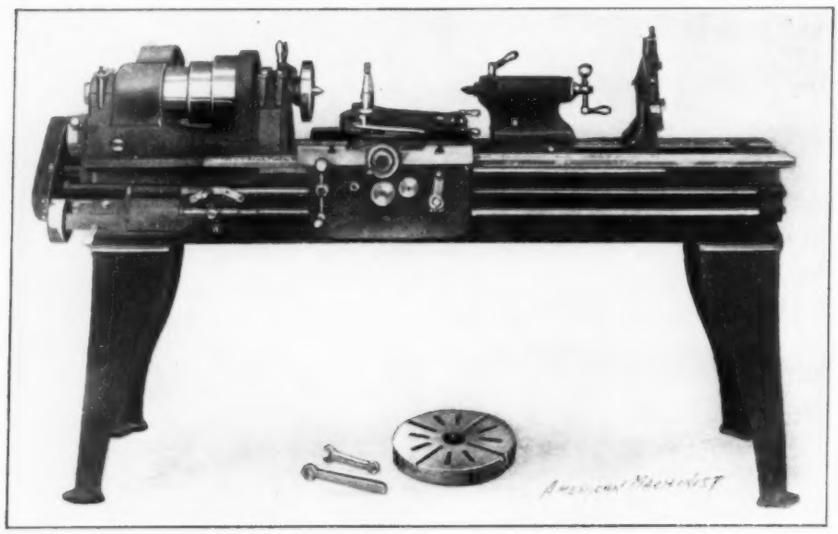
The shaft on the left-hand side is extended, which, with the finished seats, makes the application of attachments, such as side roll feed, transfer attachment or dial attachment, an easy matter without the necessity of shipping the press to the factory.

A 13-inch Engine Lathe

The halftone shows a 13-inch double back-geared manufacturing lathe built by the Willard Machine and Tool Company, Cincinnati, Ohio. This lathe is designed to withstand the strain imposed by the use of high-speed steel tools. It is intended by the builders for a "double purpose" tool, i.e., it will handle much of the heavy reduction work now done on larger lathes and is capable of handling accurate fine work within its capacity. The spindle speeds, 18 in number, are from 30 to 655 revolutions per minute. The first and second back gears have respective ratios of 3 to 1 and 8 to 1. The spindle is 2⅜ inches diameter in the front bearing and has a 1 5/16-inch hole through it. The cross-feed screw is provided with a dial reading to thousandths.

The feed is by a 1½-inch belt running on pulleys of equal diameters. A device in the apron makes it impossible to throw in both the rod and screw feed. The cone has but three steps, the smallest of these being of ample size to afford a good surface for the belt pull.

All gearing in the apron is of steel. Four quick-feed changes are obtainable by means of the lever in front of the bed below the headstock.



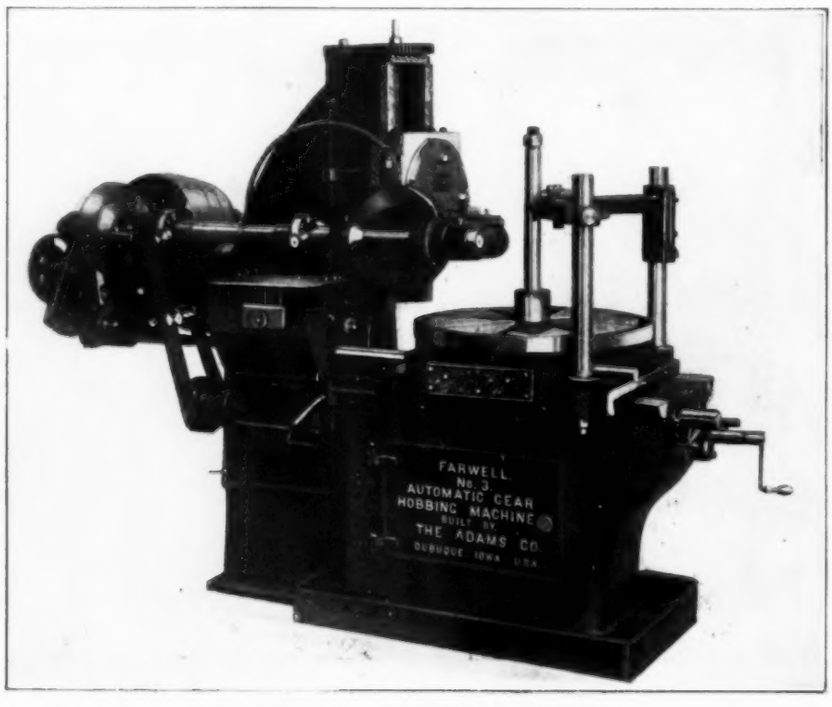
A 13-inch Engine Lathe

An Automatic Gear Hobbing Machine

The gear hobber shown in the halftone is designed for handling work up to 24 inches in diameter, three pitch, cutting 12 inches of face at a time.

On account of handling coarse pitches this tool is provided with a slide in the saddle that carries the hob, making it possible to adjust the hob spindle longitudinally, bringing any tooth exactly central with the work arbor. This is quite important in obtaining perfect gears in coarse pitches.

This longitudinal movement of the spindle head permits also the shifting of the hob to a new cutting position without resorting to moving the hob or the arbor. Several shifts may be made before it is necessary to regrind the hob.



An Automatic Gear-hobbing Machine

The head has an automatic trip to stop the down feed and is also equipped with a power mechanism for raising the head after the cut is finished. There are ten different rates of feed, all of which are obtained in the gear box. The horizontal feed mechanism for cutting worm wheels is incorporated in the design of the machine, and supplied without extra charge, as is also the special support for the upper end of the arbor. This arbor support is only necessary when gears must be swung on centers, for wide-face gears or in cutting a stack of gears of small diameter. A more rigid support can be secured in other cases by the use of face-plates or supporting rings which rest upon the table and support the blanks immediately below the rim.

The spindle is driven by a bevel gear, permitting the tilting of the hob.

The base, the column, the knee below the table and the oil pan around the machine are a single casting. The weight of the machine is over 2000 pounds.

It is built by the Adams Company, Dubuque, Iowa.

Stationary Die Head for Pipe Threading

The illustration shows a stationary die head for pipe threading as manufactured by the Landis Machine Company, Waynesboro, Penn., using the Landis type of die with a manually operated head. This is for use on pipe-threading machines where the pipe revolves. The head is made entirely of steel, as are also the die holders. The head can be mounted on the carriage of any standard pipe machine and can be handled in the usual way.

The chasers for these die heads can be made from high-speed steel, as they never require to be annealed, rehobbed or retempered. The sharpening of the die is by grinding on the ends of the chasers and again setting them to the correct cutting position in the holders by means of a small gage furnished.

The heads are made in standard sizes to take work up to and including 4 inches, one set of dies cutting all the diameters with the same pitch.

A special type of holder is used where it is not necessary to cut very close to a shoulder, having a clamp, which besides holding the chaser rigidly, protects it in case the pipe splits. The clamp comes down over the throat of the die and is rounded out near the cutting point so as to act as a guide for rough ends and, when a twister occurs in the pipe, the strain is largely thrown on the clamp, thus protecting the die. For threading close to a shoulder a clamp is used, which comes flush with the front edge of the chaser only. This type of chaser admits of high cutting speeds, and the rake can at all times be ground to suit the quality of the material in the pipe to be threaded.

The heads are graduated for setting the dies to the different diameters. It is opened and closed by hand and is rigidly locked, when in the closed position, but opens and closes freely by means of the lever. All dies are made to interchange perfectly, either singly or in sets.

The heads are made in four standard sizes taking from ¼ to 1; from ¼ to 1½; from ½ to 2; from 1 to 4 inches, inclusive.

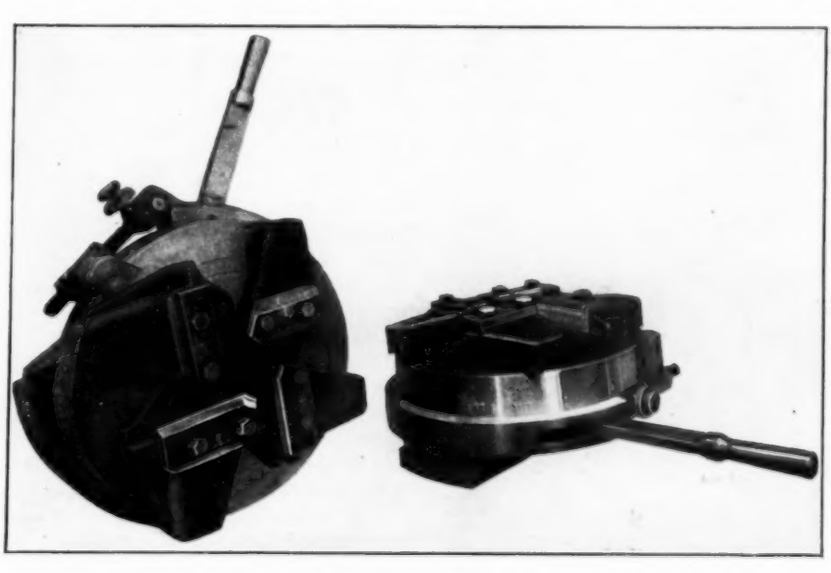
For Transferring Prick Punch Marks

The illustration shows a very handy little device made by the E. C. Bliss Manufacturing Company, 91 Sabin street, Providence, R. I., especially for toolmakers' use. There are many cases where it becomes necessary to transfer prick-punch marks accurately from one side of the piece to the other which admits many chances of error when done in the ordinary way.

The lower punch in this machine is

FOR TRANSFERRING PRICK-PUNCH MARKS

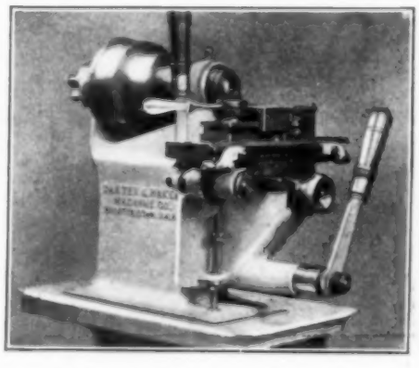
controlled by a spring and the piece to be marked is brought under the upper punch. When this has been correctly centered in the punch marks, the lower punch is pulled down and released, the spring making a sufficient blow to mark the underside exactly opposite the upper one. This is made to be fastened to a bench or other convenient place and should prove extremely handy in any tool room where work of this kind has to be done.



LANDIS STATIONARY PIPE-DIE HEAD

Bench Milling Machines

The illustration shows a new-model bench milling machine recently brought out by the Carter & Hakes Machine Company, Winsted, Conn., which, al-



A BENCH MILLING MACHINE

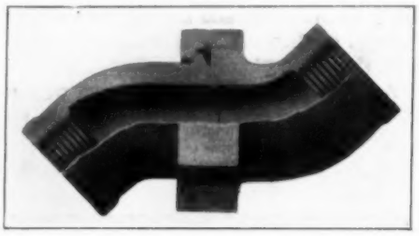
though resembling its former machine, has been improved in a number of details.

Among these changes are larger and longer bearings for the spindle, a cone of larger diameter, a wider driving belt, a knee of the solid-box type instead of the side rib or web, in addition to a wider and longer bearing surface on the column. The carriage and tables are both wider and longer and fitted with sliding stops having a screw for fine adjustment. The screw for the traverse movement of the carriage has a micrometer index graduated in thousandths, while the carriage-adjusting screw has a crank as well as a knob for operating it.

The regular equipment furnished is as follows: An overhanging arm for the support of the cutter arbor, a taper sleeve for the spindle with hole for Rivett collet, also one Rivett collet with draw back, a lever vise, countershaft and wrenches.

The Jefferson Swing Union

The accompanying cut shows the new swing union which is now being made by



JEFFERSON SWING UNION

the Jefferson Union Company, of Lexington, Mass. It consists of two 45-degree elbows with a spherically ground seat, joined together by a nut and so designed that the ends can be attached to the pipes to be connected and the nut then screwed up without interference. It is made of malleable iron, and the regular swing union has an iron-to-iron seat, but at slightly additional cost the brass-to-iron seat can be furnished.

This seat consists of a small brass ring of wrought metal cut from seamless tubing embedded in a channel cut in the concave part of the union and ground to a perfect spherical shape. The ring is small, just large enough to make a tight joint, so that the effect of expansion and contraction is reduced to a minimum.

The spherical seat makes it possible to secure a tight joint for any of the great variety of connections which can be made with this union.

One of the best etching fluids for steel is made of one part nitric acid, one part hydrochloric acid and four parts water. Keep in a bottle which has preferably a glass stopper.

The New Wright Aeroplane

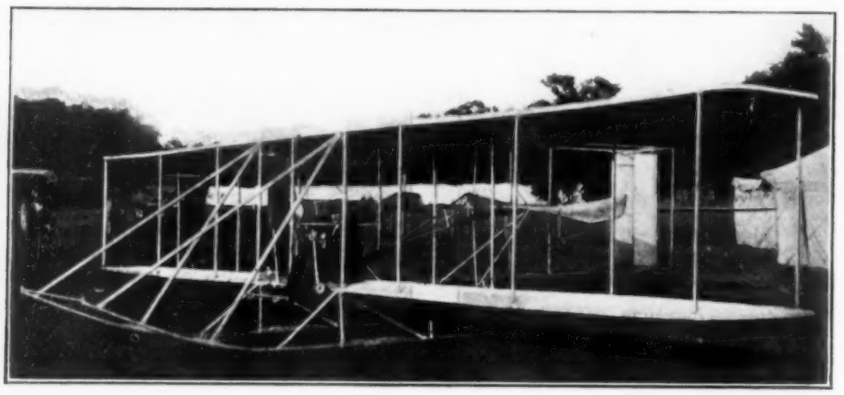
Special Correspondence

A new biplane in which the two front elevating planes are omitted and a single plane behind the rudder takes their place.

The illustration shows the latest Wright biplane, which is a marked departure from the previous machines of the Wright brothers, as it has no elevating planes in front of the main planes as in the usual biplane construction. This was designed as a cross-country flier, to take part in coming long-distance flights, and is the result of the long experience of the Wright Brothers along their chosen line. The first experiments in this line were made by Wilbur Wright, shortly after his Hudson river flight last year, with a view of overcoming the "billowing" effect which is prevalent in most machines. He found that the two front elevating planes could be dispensed with and began experimenting with a single plane in the rear. This was so successful that in the present machine they are entirely abandoned and a single, horizontal plane used behind the rudder. This makes a very decided change in the appearance of the whole machine, as can be seen from the illustration.

This is somewhat along the lines followed in the elevating devices of the Blériot monoplane, the plane being turned down to raise the machine and up to send it down. This is because the plane is behind instead of in front of the main planes, just as with a rudder in front or behind a vessel.

Although it was reported that this could not be manœuvered as readily as the machine with the front elevating planes, the performances of Walter Brookins last week demonstrated the error of this belief. In his hands it seemed to be more easily controlled in every way, turning rapidly, diving and rising, and doing other stunts which seemed sure to end in disaster to both man and machine. The soaring qualities seem to be far in excess of any other machine yet built, which adds a very desirable quality.



NEW WRIGHT AEROPLANE

Exhibit of National Machinery Company

The exhibit of the National Machinery Company, of Tiffin, O., held August 19, 22 and 23, is a novelty in machinery advertising and should prove an excellent means of familiarizing the user with the line of machines produced and serve to establish friendly relations between producer and consumer that no amount of letter writing could accomplish.

On Friday, August 19, the exhibit was visited by the International Railway Blacksmiths Association from Detroit, Mich. This party included about 300.

At least one of each of the company's regular machines was in operation in the bay of the main shop. In addition to these machines several new types were shown, including high-speed rivet machine, 1-inch, 6-spindle, semi-automatic nut-tapping machine, semi-automatic nut-burring machine, sag-screw pointer and a 1½-inch vertical thread-rolling machine.

The 3½-inch forging and upsetting machine and the 1¼-inch vertical thread rolling machine attracted a great deal of attention.

Entertaining the Engineers

Editorial Correspondence

The many hospitalities extended to the visiting engineers, members of the American Society of Mechanical Engineers, in England were too numerous for any but a brief mention.

Thursday, July 28, was set aside for all-day excursions, of which most of the ladies chose the one to Kenilworth, Warwick and Stratford-on-Avon, while many of the members went to the shops of the Daimler Motor Company and Alfred Herbert & Co., Ltd., at Coventry, and Willans, Robinson & Co., at Rugby.

Late in the afternoon the parties reached the hotel Runel in London, where headquarters were established. A conversazione was held in the home of the Institution in the evening and a lecturette was given by Dr. Hele-Shaw on the Stream Line Theory in its application to the stability of aëroplanes. By means of colored glycerin forced between plates of glass the stream lines were beautifully shown.

Friday Sessions

In the morning a professional session, devoted to electric-railway problems, was held in the auditorium of the house of the Institution of Civil Engineers. The afternoon was given over to garden parties by invitation of Sir John Thornycroft and Mr. Maw.

In the evening the Institution entertained at a banquet in Connaught rooms. Some 550 members and guests were present. The toast to the American Society of Mechanical Engineers was proposed by Sir William White and responded to by Professor Hutton. The toast to the Institution was proposed by Professor Goss and responded to by President Aspinwall. Among the other speakers was Ambassador Reid, who responded to the toast to the President of the United States.

Saturday Excursions

The best of the excursions had been saved until Saturday. Two parties were organized. One went by train to Great Marlowe, then by steamer down the Thames to Windsor, visited Windsor castle and returned to London by train. The other party covered the same route in reverse order. The beauties of the river must be seen to be appreciated.

The evening was set apart for a visit to the Japan-British Exposition.

Sunday evening brought the last meeting together of hosts and guests in a body. Westminster Abbey was visited in the late afternoon, many of its treasures were seen, and the memorial window of the great engineer Sir Benjamin Baker was especially pointed out. This ended the week of entertainment furnished by the Institution, a week filled with pleasure for all the American visitors. Many expressions of gratitude were heard from every side, from the members of the American Society of Mechanical Engineers, and they were all merited, for the members of the Institution showed themselves to be royal hosts.

Making Piston Rod Packing

In turning up soft-metal packing rings for piston rods at the Depew shops of the New York Central Railroad, they use an old lathe which has been especially fitted up for it. These packings are made up of three separate rings, which are first cast and faced, as well as bored, so as to fit together on the expanding mandrel shown in the lathe. This is in reality an expanding chuck, which screws directly on the nose of the lathe spindle and carries the rings on the three expanding blades shown. These blades are controlled by the handwheel and held in position by the light retaining spring on the outside. The outside of the rings is turned by the forming tool shown, so that the desired shape may be easily secured.

After being turned, they are carefully tested in the gages shown in Fig. 2. These gages not only show the correct diameters, but also the angle of the bevel, which is very important. In order to show this easily, openings are cut in opposite sides of the gage, one side showing the fitting of the larger rings as at *A*, and the other sides showing the correctness of the acute angles on the smaller rings as at *B*. This makes a very convenient form of gage, which can be used to advantage in many places.

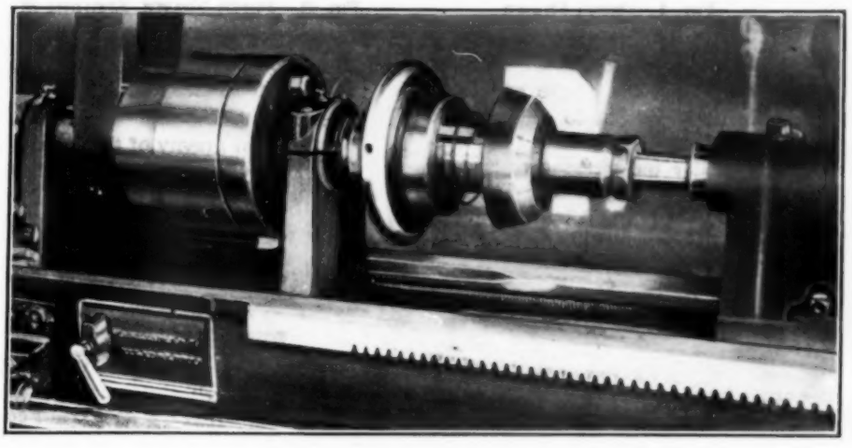


Fig. 1. Turning Piston-rod Packing Rings

Fig. 2. Gages for Testing Piston-rod Packing Rings

Safe Loads for Press Frames

By S. Hurley

How to find the safe load that may be put on a punch or press so as to avoid strains or breakage from putting too large work on it. Showing how both the compression and tension sides must be considered.

It is sometimes desirable to know the safe load to which a punching machine or press frame may be subjected, in order to calculate the size of material that may be punched or pressed. On account of the combined stresses to which such frames are subjected, the calculations necessary for this are somewhat long and tedious. However, by combining the different stresses, fairly simple formulas have been derived that can readily be applied to practical design.

When a frame of the style shown in

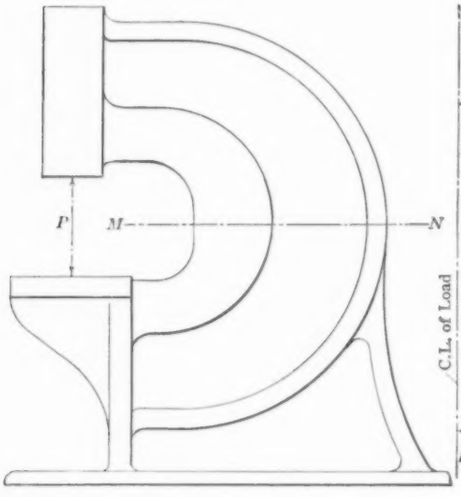


FIG. 1. PRESS FRAME

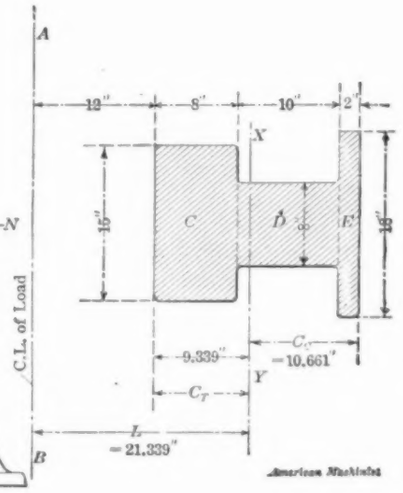


FIG. 2. PRESS FRAME, SECTION *M-N*

Fig. 1 is subjected to a load, or force P, acting in the direction of the arrows, it is said to be subjected to an eccentric load and will tend to fail along the section $M\,N$, under the stresses caused by combined flexure and tension. The load that can be safely carried by this section is expressed by the following formulas:

$$P = \frac{S_t}{\frac{1}{A} + \frac{L\,C_t}{I}} \qquad (1)$$

and

$$P = \frac{S_c}{\frac{L\,C_c}{I} - \frac{1}{A}}, \qquad (2)$$

in which

P = Safe load in pounds;

I = Moment of inertia of the section considered;

A = Area of the section in square inches;

L = Distance in inches from the center line of the load to a line passing through the center of gravity of the section, as indicated in Fig. 2;

C_t = Distance in inches from the center of gravity of the section to the extreme fiber on the tension side;

C_c = Distance in inches from the center of gravity of the section to the extreme fiber on the compression side;

S_t = Safe tensile stress in pounds per square inch, which may be taken as 4000 for cast iron;

S_c = Safe compressive stress in pounds per square inch, which may be taken as 10,000 for cast iron.

Formula (1) gives the safe load, considering the tension side of the frame, and formula (2) takes the compression side into account. P may be calculated from both formulas, and the smaller value will be the safe load of the section.

Formulas (1) and (2) are derived as follows:

The load P will set up a tensile stress in the frame equal to $\frac{P}{A}$. This will be increased on the tension side, or side nearest the work, by a further tensile stress which might be called S_1 and which is due to flexure. This stress may be deduced from the well known bending-moment formula, which is used for the calculation of beams:

$$M = \frac{S\,I}{C},$$

which would become, in this case,

$$M = \frac{S_1\,I}{C_t}.$$

But we also have

$$M = P\,L.$$

Hence,

$$P\,L = \frac{S_1\,I}{C_t}.$$

Solving this equation for S_1,

$$S_1 = \frac{P\,L\,C_t}{I}.$$

Therefore the total stress on the tension side of the section becomes

$$S_t = \frac{P}{A} + \frac{P\,L\,C_t}{I}.$$

The safe load from this is

$$P = \frac{S_t}{\frac{1}{A} + \frac{L\,C_t}{I}}.$$

The second formula is obtained by the same line of reasoning, except that here the compression side of the frame, or the side farthest from the work, is under consideration. In this case, then, we have the tensile stress $\frac{P}{A}$, and the compressive stress from bending, which we may call S_2. Again, from the bending moment, or beam, formula

$$M = \frac{S_2\,I}{C_c}$$

or

$$P\,L = \frac{S_2\,I}{C_c},$$

from which

$$S_2 = \frac{P\,L\,C_c}{I}.$$

The total stress, then, on the compression side is the difference between the two opposing stresses, or

$$S_c = \frac{P\,L\,C_c}{I} - \frac{P}{A},$$

from which

$$P = \frac{S_c}{\frac{L\,C_c}{I} - \frac{1}{A}}.$$

To illustrate the use of these formulas, dimensions have been given to the frame shown in Figs. 1 and 2, and the safe load to which it may be subjected has been worked out as follows:

It is first necessary to find the position of line $x\,y$, Fig. 2, which is the line through the center of gravity of the section. Dividing the section into the areas C, D and E, we have

C = 120 square inches,

D = 80 square inches,

E = 36 square inches.

Then, to find the center of gravity of the combined area, multiply each small area by the distance from its own center of gravity to the left-hand extreme fiber, and divide the sum of the products by the total area:

$$\begin{array}{rr} 120 \times 4 = & 480 \\ 80 \times 13 = & 1040 \\ 36 \times 19 = & 684 \\ \hline 236 & 2204 \end{array}$$

$$2204 \div 236 = 9.339 \text{ inches.}$$

Hence, the distance from the center of gravity of the section to its extreme fiber on the left is 9.339 inches.

Next, in order to find the moment of inertia, the following ordinary rule may be applied: The moment of inertia of any area about any axis is equal to its moment of inertia about a parallel axis through its center of gravity, plus the product of the area and the square of the distance between the axes. The sum of the moments of inertia of the parts of any figure about a given axis is equal to the moment of inertia of the entire figure about the same axis.

From this, then, considering the section divided into the rectangles C, D and E, and remembering that the moment of inertia of a rectangle about its horizontal axis is $\frac{bd^3}{12}$, where b = breadth and d = depth, we have

Area C, $I = \frac{15 \times 8^3}{12} + 120 \times 5.339^2 = 4062.5$

Area D, $I = \frac{8 \times 10^3}{12} + 80 \times 3.661^2 = 1738.6$

Area E, $I = \frac{18 \times 2^3}{12} + 36 \times 9.661^2 = 3370.8$

Total moment of inertia = 9171.9

The other known values to be used in the formulas are:

$S_t = 4000$ pounds per square inch, considering the frame to be of cast iron;

$S_c = 10{,}000$ pounds per square inch,

$A = 236$ square inches,

$L = 21.339$ inches,

$C_t = 9.339$ inches,

$C_c = 10.661$ inches.

Substituting in (1),

$$P = \frac{4000}{\frac{1}{236} + \frac{21.339 \times 9.339}{9171.9}}$$

$$= 154{,}440 \text{ pounds.}$$

Substituting in (2),

$$P = \frac{10{,}000}{\frac{21.339 \times 10.661}{9171.9} - \frac{1}{236}}$$

$$= 487{,}800 \text{ pounds.}$$

These results show the tension side of the section to be considerably weaker than the compression side; hence the safe load for the frame should be taken as 154,440 pounds. This means that the frame will safely withstand a force of 154,440 pounds applied in the direction of the arrows in Fig. 1.

The safe load for any frame of this style may be calculated in exactly the same manner, that is, by finding the result for each side and selecting the smaller.

Cause of Skew Teeth in Hobbing

By George B. Grant*

The theory of the hobbing gear-cutting machine says that you can plump the hob right into the work just anywhere and without bothering to center it, as must be done when using the ordinary single cutter; therefore your hob must be wrong. It takes a week or two to prove that the hob is perfectly symmetrical and straight. (It seldom or never is, but that is an item of a separate discussion). You finally find out, or some friend lets you know that the theory is askew, and that you must center the hob every time. One of the cutting edges must be brought to center, and then the teeth come straight.

It is not at all necessary to follow the matter further, for it is easy enough to center the hob and nothing more is required, but some people are inquisitive and want to know the why and wherefore of their troubles.

To lay this skew trouble out so it can be seen without a microscope we will assume a greatly exaggerated case, as in the accompanying figure.

The cutter shaft carries a single fly cutter. A hob is nothing whatever but a number of fly cutters arranged in a spiral line around the arbor, and this may be called a hob with a single tooth. The thin disk is geared to turn as the cutter shaft turns and in the proportion of, say, nine to one.

If the cutter is set as shown by the dotted lines; that is, on center, it will chop out a tooth space in the thin disk every time it comes around, and the result will be the toothed wheel shown by the dotted lines. It is central and skewless.

But, suppose you set the cutter off center, just as it happens to come; you get the result shown by the full lines and shaded part, a ratchet wheel, or a skew gear wheel. The skew is due wholly to the bad centering of the cutter, for there is no other difference between the two processes.

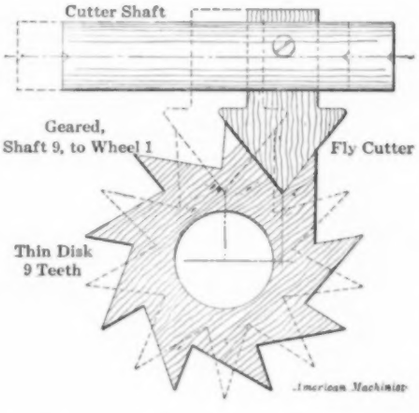


DIAGRAM ILLUSTRATING CUTTING SKEW ON A GEAR-HOBBING MACHINE

When there are many teeth in the hob, instead of only one, the amount of the error in centering will be very small and the resulting skew will be small, perhaps not noticeable. But there will always be a skew, however small, unless the hob is centered.

The remedy is to center the hob, but if its teeth are close together, or if the diameter of the hob is great, or if the tooth is small, the skew may not be troublesome.

All the above remarks apply to the ordinary worm gear, for it may have both flats and a skew if the hob is small and the teeth far apart.

There is a kind of gear-hobbing machine which operates with a single-tooth hob; that is, a fly cutter, and it can be made to apply to spur and spiral gears by giving it the required feed in the direction of the tooth it is cutting. But life is too short for the fly cutter in these days when the customer wants his gears day before yesterday, and unless the shop is out in the woods where land is sold by the acre the fly-cutter machine cannot be made to earn the taxes on the real estate it takes up.

Perhaps I am the discoverer of the cause of the "flat" and of the reason for the "skew." I have not seen any prior publication on either item.

*President, Philadelphia Gear Works.

Checkering Plier Handles

A reader would like to know the best way to checker the handles on a special plier that he is making in lots of 10,000. The material is 0.25-point drop-forged steel, and they are to be finely finished, nickel plated. He wants a first-class, good job.

Increasing Shop Capacities

Metal Working

The Andrews Wire and Iron Company will locate at Watford, Ont.

The Sebring (Ohio) Automobile pany will build a factory.

The Omaha (Neb.) Structural Steel Works is to erect a new plant.

The Racine (Wis.) Brass and Iron Company will build an addition.

The Wheeling (W. Va.) Hinge Company is building a four-story factory.

The Haydenville (Mass.) Button Company is looking for another location.

The Simplex Electric Company, Cambridge, Mass., will erect a new factory.

The Landy Shovel and Tool Company will locate a plant at Peterboro, Ont.

The Foos Gas Engine Company, Springfield, Ohio, will erect an addition.

The Lima (Ohio) Locomotive Works is building a foundry to cost $100,000.

The La Crosse Plow Company, of La Crosse, Wis., will enlarge its plant at once.

The Canadian Ornamental Iron Company will build a large plant in Toronto.

The Ingersoll-Rand Company is building an addition to its shop in Athens, Penn.

The Campbell Electric Company, of Lynn, Mass., is in the market for a power press.

The International Harvester Company will build a new foundry at Milwaukee, Wis.

The Hamilton (Ont.) Bridge Company is making very extensive additions to its plant.

The Howard Motor Car Company, Galion, Ohio, is taking bids on an automobile factory.

The Motsinger Rotary Engine Company, Greensburg, Penn., is seeking a new location.

The United Motors Company, of Detroit, Mich., will establish a factory in Welland, Ont.

The Knox Automobile Company is making extensive additions to its factory at Springfield, Mass.

Fire did $5000 damage at the Pratt & Letchworth foundry on Tonawanda street, Buffalo, N. Y.

The Perry Iron Company, Erie, Penn., has taken out a permit for an addition to its casting house.

The Cleveland (Ohio) Wire Spring Company is preparing plans for an extension and new equipment.

Whiting & Davis, jewelry manufacturers, Plainville, Mass., will build a large addition to their plant.

The Gorham Manufacturing Company, Providence, R. I., is erecting a large addition to its foundry.

The Canadian Northern will build a roundhouse and coal sheds, etc., to cost $1,000,000 at St. Boniface.

The International Tool Steel Company, of Toronto, Ont., will commence to erect soon a plant at Cobourg.

The Canada Cycle and Motor Company, Toronto, Ont., is building extensions to cost $100,000 to its plant.

The Smith & Watson Iron Works, Portland, Ore., is erecting a new building to be used as a blacksmith shop.

The Star Electric Company, Lestershire, N. Y., making fire-alarm systems, will erect an addition to its factory.

News items for the sales department—where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip—facts.

The Superior Iron and Manufacturing Company, Wauseon, Ohio, will soon start the erection of a 10-ton cupola.

The Packard Motor Company, of Philadelphia, Penn., will erect a large garage at Broad and Wood streets.

The Schultz Baking Company, Brooklyn, N. Y., is to build a new auto garage in Hoboken, N. J., to cost $25,000.

The Templeton Barrett Company, of Milwaukee, Wis., will locate its hardware-manufacturing plant at Marionette, Wis.

The Sanford-Day Iron Works, Knoxville, Tenn., which is now making improvements at its plant, is to erect a new foundry.

The Gilson Manufacturing Company, Guelph, Ont., building gasolene engines, will double its plant and install latest machinery.

The Harris Automatic Press Company, of Niles, Ohio, has increased its capital stock and contemplates extensive improvements.

The Frost Pump Company, Bristol, Va., a new concern, is erecting a plant for the manufacture of a pump invented by Horace Frost.

Fire destroyed the blacksmith and wheelwright shop of T. F. Murphree and Himberg's machine shop and garage, Troy, Ala.

The Great Western Manufacturing Company, La Porte, Ind., is building an addition to be used as a machine shop and forging room.

Fire damaged the plant of the Eagle Foundry Company, 2601-11 University avenue, S. E., Minneapolis, Minn., to the extent of $7000.

The Automatic Machine and Tool Company, Toledo, Ohio, has moved into larger quarters at 369 South Erie street and is remodeling its building.

The Galesburg Coulter-Disc Company, of Galesburg, Ill., is looking for a location for a steel-disk factory, which will employ about 300 men.

The Southern Pacific Company will erect an addition to its machine shops at Sparks, Nev., which will be known as the wheel-fitting shop.

Fire destroyed the plant of the Cumberland Foundry and Manufacturing Company, and machine shop of John Bouchard & Son, Nashville, Tenn.

A new roundhouse, 75 feet long, will be built in the yards of the New Haven Railroad, at Springfield, Mass., to take the place of the present one.

The Russell & Erwin Hardware Manufacturing Cmpany, New Britain, Conn., has opened a new six-story factory. New machinery will be installed later.

The Cameron Car Company, of Beverly, Mass., is investigating throughout the Northwest section with a view to obtaining suitable site for a factory.

The National Enameling and Stamping Company, Baltimore, Md., is having plans made for an addition to its factory at Light and Winder streets.

Building permit has been issued to the National Brake and Electric Company, Milwaukee, Wis., for a $70,000 machine shop and a $40,000 warehouse.

The General Electric Company will shortly ask for bids for the erection of a four-story factory to cost $400,000, at the Stanley plant, in Springfield, Mass.

The Walker Automobile Company, of which D. J. Walker, of Walkerville, Ont., is president, will build a large new factory either at Detroit, or Windsor.

The Durand Steel Locker Company, whose plant at Waukegan, Ill., burned recently, has secured site at Chicago Heights on which a new plant will be erected.

It is reported that the New York Central is negotiating for the purchase of the Youngstown Car Manufacturing Company plant, to be utilized for a new car shop.

The Minnesota Steel Company, Duluth, Minn., has secured a permit for a new steel plant near Duluth, to cost $10,000,000. The plans call for 48 separate structures.

The Fulton Company, Knoxville, Tenn., which manufactures steam-fitting specialties, will erect a new building to be used as a brass foundry for making brass fittings.

The Climax Lock and Ventilator Company, Buffalo, N. Y., incorporated with a capital of $150,000, is investigating throughout the Central West with a view to removing its plant.

A. H. Wyatt and W. H. Kitts, of Cleveland, Ohio, are preparing to erect a motor-car factory at Lisbon, Ohio, the people of that place having raised a fund of $25,000 as a bonus.

Work will be begun in a few days on a new foundry building for the Deane Steam Pump Company, Holyoke, Mass. This is the last of three big buildings planned for erection this year by the company.

The Chicago & Northwestern Railroad is to construct one of the most extensive machine and engine shops in Chicago. Building permit has been taken for the shops at Fortieth and Kinzie streets, to cost $500,000.

The Damascus Brake Beam Company, who e plant at Sharon, Penn., was recently burned, has purchased site in Cleveland, Ohio, and will erect a $150,000 plant. The company has an office in the Citizens building.

A large garage building is to be erected by the Mississippi Valley Trust Company, on Delmar avenue, near Taylor, St. Louis, Mo., to be occupied by the Columbia Taxicab Company. This will have a machine shop of 130x30 feet.

The New York Car and Truck Company, Kingston, N. Y., has been secured by the Woods Automobile Company. The new company is reconstructing its plant and adding new equipment. Still more is needed, especially power equipment.

The additions which the Union Twist Drill Company, of Athol, Mass., are now building, include a four-story building to be used as an extension of the drill business, which is to have modern wash rooms, etc. There will also be built a one-story addition to the hardening room.

General Manufacturing

Prince Albert, Sask., will install a new filtration plant.

Winnipeg, Man., will expend $600,000 on a new gas plant.

The Canada Keg and Barrel Company will locate in Toronto.

Souris, Man., will install a complete new waterworks system.

The town of Rainy River, Ont., will build a large new pumping station.

The Spring Lake (N. J.) Water Works will build a new pumping station.

The Harvey Shoe Company, Gardner, Me., will install a new water wheel.

The Estherville, Iowa, flour mills were destroyed by fire. Loss, $18,000.

The Toronto Type Foundry will locate a branch factory at Wadena, Sask.

The Ripon Produce Company, of Ripon, Wis., will erect a creamery plant.

P. Burns, of Calgary, Alberta, will locate a complete packing plant at Regina.

The Pipper Light and Power Company will equip a plant at Montreal, Canada.

J. Cole & Co., Melrose, Mass., will purchase a 14- or 15-inch buzz planer.

A new ice plant will be erected by the Pottstown (Penn.) Brewing Company.

David E. Russell, Newfield, Me., is in the market for a single-clapboard planer.

The Hamilton Tube Company will locate a large branch factory at Welland, Ont.

Fire destroyed McLaggan Brothers' sawmill at Blackville, N. B. Loss, $10,000.

The Peterboro (Ont.) Canoe Company is building a large addition to its works.

The Washington Woolen Mills, Fredericksburg, Va., was burned. Loss, $150,000.

The Mitchell Greenhouse Works, Poughkeepsie, N. Y., is building a new plant.

The Zanesville (Ohio) Mould Company is asking for estimates on a new equipment.

The Catskill Cement Company, of Cementon, N. Y., is erecting a new power plant.

The installation of a municipal electric-light plant at Bowdle, S. D., is projected.

Plans will be prepared for the installation of a waterworks system at Gettysburg, S. D.

The Dominion Shoe and Slipper Company will equip a new factory at Berlin, Ont.

The Canada Sugar Refining Company, Montreal, Canada, is building a large addition.

The Ottawa (Ont.) Light, Heat and Power Company will equip a large new substation.

The Canada Reflector and Mirror Company will locate a large factory at Hamilton, Ont.

The Des Moines (Iowa) Silo Company will build a $10,000 addition and double its output.

The Robert Simpson Company, of Toronto, Ont., is building a large wagon and harness shop.

The Liquid Carbonic Company, of Chicago, Ill., will erect a $400,000 plant in Memphis, Tenn.

The Canadian Northern Railway will spend $300,000 increasing its facilities at Regina, Sask.

The Plimpton Press, Norwood, Mass., is contemplating the erection of a one-story addition.

J. A. Minchener, of Stratford, Ont., will locate a large new furniture factory in Owen Sound.

C. E. Giddings, Hudson, Mass., is in the market for a 12- to 15-horsepower gasolene engine.

New Glasgow, N. S., will spend $250,000 in equipping a complete new waterworks system.

The Peoples Coal Company, Taunton, Mass., is taking prices on hoisting engines and boilers.

H. W. Forbes' basket factory at Rock Creek, Ohio, was destroyed by fire. Loss, $20,000.

Fire practically destroyed the glove factory of J. S. Lehman, Johnstown, N. Y. Loss, $25,000.

Peterboro, Ont., is calling for tenders for electrically operated air compressors and ejectors.

The Melville Woolen Mills, Fredericksburg, Va., were destroyed by fire. Loss, about $150,000.

The Walpole (Mass.) Rubber Company will build an addition, doubling the capacity of its plant.

Brown & McColley, Winchendon, Mass., manufacturing wood-seat chairs, will erect a new shop.

It is proposed to vote on issuing bonds for $50,000 for a new waterworks system at Belle Fourche, S. D.

H. Wegwart, of Burlington, Wis., is looking for a suitable location on which to erect a basket factory.

The Thiry Cleaning and Dyeing Company will erect a $30,000 plant at Hyde Park, near Reading, Penn.

The Perfect Tank and Seat Company will build a new factory on North Beech street, Syracuse, N. Y.

The John Deere Plow Company, of Omaha, Neb., will build a factory for the manufacture of silos.

Bonds for $10,000 for the installation of an electric-light plant at Farmington, Minn., have been voted.

The E. & H. Levy Company, 280 Pearl street, New York, is looking for a site for a weaving plant.

Fire destroyed the elevator of the Rutland Transit Company, at Ogdensburg, N. Y., causing a loss of $200,000.

A vote will be taken August 30, for the issuing of $10,000 in bonds for a waterworks system at Onida, S. D.

A complete electric-light plant will be installed at Crandon, Wis. August H. Meyer, engineer, Appleton, Wis.

A hydraulic laboratory is being erected for the Engineering College of Syracuse University, Syracuse, N. Y.

The broom factory of W. L. Skinkle & Co., at Scotia, N. Y., was damaged by fire to the extent of $5000.

The council, Alexandria, Minn., voted to install another unit at the electric-light plant to cost about $4000.

Daniels & Fisher, Denver, Colo., are erecting a large addition and expect to install some new power equipment.

The South Shore Traction Company has purchased site for a power plant in Oakewood avenue, Bayport, L. I.

The Colwell Lead Company, now at Lafayette and Walker streets, New York, will erect a new factory in the Bronx.

The Narragansett Electric Lighting Company, of Providence, R. I., will install a new steam turbine and generator.

The plant of the Flexible Veneering Company, of Pawtucket, R. I., was damaged by fire to the amount of $10,000.

E. H. Lundy, of Eldora, Iowa, will ask for a franchise and will construct a $10,000 concrete dam and a new power plant.

The grain mill of the Taylor Milling Company, Los Angeles, Cal., was destroyed by fire. Loss, $15,000. Will be rebuilt.

The city of Boston, L. R. Rourke, superintendent of streets, is requesting bids for two steam-turbine driven centrifugal pumps.

The Peoples Railway, with headquarters at Stratford, Ont., will be in the market for large quantities of electrical equipment.

Winnipeg, Man., will expend $250,000 for new machinery, etc., for extending its high-pressure waterworks fire-fighting system.

The Ontario & Manitoba Flour Milling Company will erect a mill at Sudbury, Ont., to have a daily capacity of 2000 barrels.

The Illinois Electric Porcelain Company will erect a plant in Macomb, Ill., for the manufacture of electric supplies out of clay.

The Kratz Shingle Company, Clatskanie, Ore., has commenced the erection of an up-todate mill to replace the one recently burned.

The Hocking Valley Creamery Company, Athens, Ohio, recently organized, will erect a plant for general creamery and ice-cream business.

A new factory will be started in Leominster, Mass., by the Blanchard-England Company for the manufacture of celluloid novelties.

The plant of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., was damaged by fire to the extent of $27,000.

The Suburban Gas Company will erect a gas plant at Houston Heights, Tex. The company was incorporated recently and granted a franchise.

M. D. Stoner, of Brainerd, Minn., is considering the construction of a power plant, about 10 miles southwest of Brainerd, to cost about $300,000.

A franchise has been granted to Edward Nichols, of Belle Plaine, Iowa, to install a high-pressure water-gas plant to cost about $30,000 at that place.

The Allen Switch Company, Pueblo, Colo., capitalized at $100,000, will erect a plant for the manufacture of the Allen electric switch. A. B. Allen is president.

The Longdin & Brugger Company, of Fond du Lac, Wis., will erect a three-story addition for the manufacture of automobile tops, etc., to cost about $20,000.

The Crandall-Stone Company, Binghamton, N. Y., is erecting a large addition to its plant. The company manufactures carriage trimmings and hardware supplies.

Machinery in the power plant of local electric company, at Chippewa Falls, Wis., was damaged to the extent of $10,000 by the breakage of the main shaft.

C. E. Cooper and August Cirkel, of Boyd, Wis., will establish a factory for the manufacture of table and chair legs and rough stock in furniture to cost $100,000.

The Camera Works of the Anco Company, of Hartford, Conn., will be moved to Lestershire, N. Y., occupying the building vacated by the Marshall Furniture Company.

The E. E. Denniston Company, Buffalo, N. Y., manufacturing automobile tops, now at 184 West Mohawk street, will build a new factory as soon as a suitable location is secured.

The Tonawanda (N. Y.) Board and Paper Company is making extensive additions to its plant on Goose Island. Ground has been broken for a new building for the paper-box department.

The Republic Rubber Company, Youngstown, Ohio, awarded contracts for the erection of additional six-story building to the tire department, which will increase the output of tires 100 per cent.

The Joseph R. Loftus Company is preparing to erect a warehouse at El Centro, Im-

perial Valley, Cal., to cost $35,000, to handle cotton machinery and planters' supplies. A compress for packing cotton will be installed.

James Kerns, formerly of Wayne, Mich., has organized a company to be known as the Chelsea Carbureter Company, to manufacture carbureter invented by him. The company is capitalized at $1,000,000 and is located in the Mack building.

The Boston (Mass.) Elevated Railway is about ready to place orders for between $1,200,000 and $1,400,000 of additional rolling stock. The cars to be ordered include 100 surface semi-convertibles and between 30 and 40 new elevated cars.

Bids for a complete high-pressure, water-gas plant, with about six miles of mains, will be opened at Belle Plaine, Iowa, September 10. Site for the plant has been bought and a franchise secured. Further information may be had from H. R. Mosnat, Belle Plaine, Iowa.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids September 6, for 453,600 pounds steel castings, 12,000 pounds nickel steel forgings, 4875 pounds springs steel, 5400 pounds nickel steel, 18,900 pounds forged steel (schedule 2828), 1950 pounds tool steel (schedule 2837).

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids September 6, for brass pipe fittings, brass unions (schedule 2830), iron pipe fittings (schedules 2837 and 2835), flexible copper tubing (schedule 2837); September 26—600 pounds rolled naval brass, firebrick, asbestos felting (schedule 2841).

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open the following bids: September 6—Appliances for use with oxyacetylene welding plant (schedule 2824), twist drills, pneumatic hose, hand reamers (schedule 2831), steam gages, water-gage glasses (schedule 2830), turbo-generating sets (schedule 2826).

New Incorporations

Standard Saw and Tool Manufacturing Company, Kane, Penn. Capital, $50,000. R. A. Hill, Kane, treasurer.

Furner Motor Car Company, Chicago, Ill. Capital, $25,000. Incorporators, Edward Furner, A. W. Eschert, W. J. Bell.

Hoey & Gallagher Foundry and Machine Company, Kittanning, Penn. Capital, $50,000. Incorporators, P. J. Hoey, S. W. Gallagher.

Crown Stove Works, Cicero, Ill. Manufacture stoves and ranges. Capital, $60,000. Incorporators, John Rogers, Jacob Ringer, Theo. Rubovitz.

Aerovehicle Company, Atlantic City, N. J. Manufacture airships. Capital, $125,000. Incorporators, Jas. R. Greig, S. C. Fenner, E. H. Chandler.

Pitner Pump Company, Chicago, Ill. Manufacture pumps, etc. Capital, $20,000. Incorporators, M. W. Pitner, Jasper Gibbs, George E. Graves.

Plural System Ventilator Company, Chicago, Ill. Manufacture ventilators and furnaces. Capital, $50,000. Incorporators, N. A. Beck, F. P. Mies, E. C. Martin.

Fort Dodge Portland Cement Company, Fort Dodge, Ia. Capital, $3,500,000. Incorporators, F. D. Brandenburg, Sioux Falls, S. D.; M. J. Nicholson, H. W. Hendricks, Rapid City, S. D., etc.

Capital Broom Company, Newark, N. J. Manufacture brooms. Capital, $25,000. Incorporators, A. G. Smith, Harry Schwerin, Rudolph Krimke.

Stover Motor Car Company, Cincinnati, Ohio. Capital, $25,000. Manufacture and sell motor cars and automobiles of all kinds. Incorporators, L. K. Emerson, George W. Platt, R. L. Dallings.

Elias Puterman Company, New York. Manufacture articles of brass and other metals and alloys. Capital, $18,000. Incorporators, Elias Puterman, 118 Eldridge street; Samuel Puterman, 297 Broome street, etc.

The Carbon Products Company, Cincinnati, Ohio. Capital, $100,000. Manufacture and sell products and by-products of carbon in all their forms. Incorporators, Clay B. Steele, Anthony Larney, Morris James Dale.

Erie Wrench Company, New York. Manufacture wrenches, tools and machinery. Capital, $10,000. Incorporators, Edwin A. Denham, 45 West Thirty-fourth street, New York; Leslie A. Pease, Edwin G. Mease, of Dunkirk, N. Y.

Sanitary Clothes Pressing Company, Cincinnati, Ohio. Capital, $50,000. Manufacture and sell machinery for pressing, laundering, dry cleaning and manufacturing clothes. Incorporators, Fred M. Betz, Lem S. Miller, Oliver Y. Farbach.

Business Item

The Olmstead-Flint Company, offices at 136 Liberty street, New York, and 1026 Arch street, Philadelphia, has been organized to manufacture a complete line of leather, balata, canvas-stitched, rubber and solid woven belting. The incorporators of the new company are Willard I. Olmstead, Stanley B. Flint and George S. Baker.

Forthcoming Meetings

National Society for Promotion of Industrial Education, fourth annual convention, Boston, Mass., November 17, 18 and 19.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E. G. Smith, Columbia, Pa.

We buy or pay royalty for good patented machine or tool. Box 282, Amer. Machinist.

The "Gas Saver" brazing forge; circular. J. L. Lucas & Son, 2 Fox St., Bridgeport, Ct.

Wanted—Work for screw machines and gear cutter. Box 775, American Machinist.

Machinery to order, or will purchase good patents. Interstate Machinery Co., Troy, N. Y.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Special machinery accurately built. Screw machine or turret lathe work solicited. Robert J. Emory & Co., Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Light or medium weight machinery to manufacture on contract or special machinery to build. Box 734, American Machinist.

We are experts on piston rings for all makes of engines; get more power out of your motor; let us make your rings. Wheeler Engine Works, Bridgeport, Conn.

Wanted—Brown & Sharpe No. 2 or No. 13 universal grinding machine; must be A-1 condition; state price and condition of machine. Address The Yale & Towne Mfg. Co., Stamford, Conn.

A large English firm of machine-tool importers having showrooms and offices in Great Britain, France, Italy and Japan, is wanting good agencies for machine tools of all kinds. Apply Box 189, American Machinist.

Any broken machinery parts expertly welded by oxy-acetylene process; difficult repairs requiring skilful preheating are our specialty; automobile cylinders and crank cases also; ask for detailed information, references, etc.; we positively weld (not braze) cast iron, aluminum and other metals; no charge unless successful; one trial will convince you. Waterbury Welding Works, Waterbury, Conn.

A very attractive proposition for representative wholesale hardware dealers or district sales agents in principal cities of United States and Canada to handle a high-speed steel made in Sheffield, England, by one of the largest concerns of its kind in the world; have manufactured tool steel of the various kinds successively introduced for over a hundred years; steel already established in several sections of this country, and used by some of the largest consumers; owing to standing and prestige of the manufacturer, only highest class of connections solicited or entertained; communications from principals only; highest references given and exacted in return. Address "High Speed," Amer. Mach.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—First-class man on automatic screw machine work, setting up, camming, devising new tools and methods speeding up; highest wages to the right man. Box 825, American Machinist.

CONNECTICUT

Wanted—Salesmen to handle on a generous commission basis, a well advertised and quick selling line of lathe tools; commissions given on all orders received from prescribed territory; send references with reply. Address "R. T.," American Machinist.

DELAWARE

Wanted—A man who is thoroughly competent to take charge of profiling machines in the manufacture of high-grade firearms; we have an excellent opportunity for a competent man to advance himself to his full capacity; steady employment and good wages will be paid successful applicant. Box 897, Am. Ma.

ILLINOIS

Wanted—By growing Chicago concern, first-class draftsman with experience in original designing and ability to work out ideas submitted; also a high-grade die and tool designer of experience, with a thorough practical knowledge of die making; must be a good

draftsman; in each case give age and experience in full and wages desired in first letter. Box 892, AMERICAN MACHINIST.

INDIANA

Wanted—A-1 man for tempering tools; one who has experience in case-hardening preferred; give experience and references. Address "A. B. C.," Box 186, Indianapolis, Ind.

Wanted—Foreman, a man capable of handling motor, rear axle, transmission and chassis assembly in factory where quality first then quantity counts; factory located at Indianapolis, Ind. Box 906, AMER. MACH.

Wanted—A thoroughly capable foreman for tool room employing twenty toolmakers and machinists; must be naturally endowed with capacity to command respect of workmen and be thoroughly experienced in very accurate and exacting punch and die work. Address "A. B. C.," Box 186, Indianapolis, Indiana.

MASSACHUSETTS

Wanted—Experienced and designing draftsmen. Address replies to Supervisor of Drafting Rooms, General Electric Co., Pittsfield, Mass.

Wanted—Machine and tool designer accustomed to work on special and automatic machinery for small parts; permanent and growing position for right man. Box 871, AMERICAN MACHINIST.

Wanted—A-1 cost accountant, one experienced in machine shop, foundry and pattern shop costs, and capable of handling help; answer, stating age, experience, salary expected and where at present employed; all answers treated confidential. Address "Confidential," Box 896, AMERICAN MACHINIST.

MICHIGAN

Wanted—Toolmaker, experienced in accurate small and medium size general tool work; married man; state wages and give references. Hancock Mfg. Co., Charlotte, Mich.

NEW JERSEY

Lathe and vise hands in shop, 15 miles from New York; must be sober and steady; opportunity for advancement; state experience, references, wages and all information in first letter. Box 843, AMER. MACHINIST.

NEW YORK

Wanted—Cost department clerk for established machinery manufacturing company; good position; salary $25 per week; state age, experience and references. Box 911, AM. MA.

Wanted—Four or five first-class all-around machinists and two good patternmakers; give full details of past experience, where now employed, reference and age; good wages and permanent employment to good men. Box 881, AMERICAN MACHINIST.

Draftsmen Wanted—A large and well known automobile company in New York State requires experienced mechanical draftsmen and detailers; give age, experience and salary expected and when could report for work. Box 898, AMERICAN MACHINIST.

OHIO

Wanted—A machine shop foreman, charge of 35 men, who is familiar with piece work; give references. Box 893, AMER. MACHINIST.

Wanted—Superintendent in Cincinnati, experienced in building lathes and radial drills; applicant must show good past record and must be capable of assuming entire charge of the manufacturing end of our business. Box 862, AMERICAN MACHINIST.

Wanted—First-class machinists, toolmakers die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood patternmakers, brass molders, polishers, buffers, finishers, spinners, millwrights, hammermen and blacksmiths who are seeking positions or desirous of improving on those which they have, to register their names and addresses with the free Employment Department of the National Metal Trades Association. Address Commissioner's Office, 605 New England Bldg., Cleveland, O.

PENNSYLVANIA

Wanted—Floor hands and fitters on machine tool work. Colburn Machine Tool Co., Franklin, Penn.

Wanted—Diemakers, experienced in making blanking and bending dies for small brass and steel punchings; in replying, state experience, age and nationality. Box 903, AM. M.

Blacksmith foreman for Philadelphia plant; fully experienced and competent to take entire charge of 200 men and thoroughly familiar with heavy forging machines, steam drops, bulldozers, etc. Box 905, AM. MACH.

Wanted—A man capable of originating and mechanically developing new and novel articles of hardware for household, store or farm use; state past experience and accomplishments, also salary expected. Box 876, AMERICAN MACHINIST.

Toolmaker, capable of perfecting the design of automatic tapping machinery applied to small malleable pipe fittings; a steady job in a shop of the better class for a man capable of producing results in economical manufacture; answers from distant points not desired. Wirt Electrical Mfg. Co., Lena and Armatt Streets, Germantown, Philadelphia.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—Scrapers, experienced on medium machine tools; expert men only; highest pay, steady employment. Box 907, AMER. MACH.

Wanted—Salesman on hoisting engines; must be acquainted with the trade; opportunity of a life time for the right man; applications will be received until September 1. Box 850, AMERICAN MACHINIST.

Wanted—Superintendent for shop on medium heavy engine work; splendid opportunity for the right man; must be uptodate and able to modernize in the best sense of the word; no system crank need apply; applications received until September 1. Box 849, AM. MA.

TENNESSEE

Wanted—First-class machine tool repair man, regular toolmaker who can handle repairs preferred; give experience and reference; permanent position to right man. Address Southern Engine & Boiler Works, Jackson, Tenn.

WISCONSIN

Wanted—Draftsman, bright young man to take charge of a small drafting room. Address "A. Z.," AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

MASSACHUSETTS

Special machine designer wishes to change. Box 864, AMERICAN MACHINIST.

Man with technical training, experience as chief draftsman, systematizing shop work, assistant superintendent, installation of premium system, wants position of assistant superintendent or installing premium system. Box 879, AMERICAN MACHINIST.

Office executive, young man capable of assuming full responsibility; specialist on cost work; production man and systematizing; good correspondent; at present and for a number of years employed by large manufacturing concern; can furnish A 1 reference. Box 904, AMERICAN MACHINIST.

Works manager, consulting engineer, supervising engineer, a graduate engineer with a broad and somewhat unusual experience, covering 18 years in all-around mill engineering, is open for engagement; experience includes development and construction of special machinery, works management, steam and hydraulic engineering, application of electric drives, power plant construction, equipment and operation, mill design and construction. G. H. Miller, 135 Lincoln St. Holyoke, Mass.

MICHIGAN

Position as practical shop-school instructor wanted by well qualified, successful tool room foreman; references. Box 899, AM. M.

Thorough, reliable, twenty years' experience, toolmaker, diemaker, tool room, gear department and machine room foreman; best references. Box 900, AMER. MACHINIST.

Wanted—Situation by an all-around machinist, with experience on electrical work; strictly temperate; can furnish best of references; West preferred. Box 894, AMER. MACHINIST.

NEW JERSEY

Experienced mechanical draftsman wishes position. Box 908, AMERICAN MACHINIST.

A first-class automatic screw machine man wishes to take charge; is fully familiar with Brown & Sharpe, Cleveland, Acme and Pratt & Whitney automatic screw machines; also the designing and laying out of cams and tools for the same; has been in charge of automatics for twelve years and can furnish the best of references. Box 902, AM. MACH.

NEW YORK

Mechanical engineer, 10 years' experience, open for engagement. Box 855, AMER. MACH.

Mechanical superintendent of a large manufacturing plant, with twenty years' experience in general machine and foundry practice, desires making a change. Box 901, AMERICAN MACHINIST.

Young man as chief clerk or office manager; 15 years' experience at cost work, estimating, purchasing, shipping and receiving, store room and payroll work; can install uptodate systems. Box 910, AMERICAN MACHINIST.

Draftsman (31), English; experienced in plant layouts for electrical, chemical and industrial works, also general machinery; is unemployed; reliable; New York references and clean record. Box 909, AMER. MACHINIST.

Superintendent, capable executive and organizer in all departments; established reputation for improving and increasing production and lowering costs; interchangeable and general work. Box 848, AMER. MACHINIST.

Man of integrity, 35 years of age, to become a member of a good firm, who needs a first-class mechanical man to take charge of the manufacturing end of the business; am now general superintendent of plant composed of drafting room, machine shops, pattern shop and foundry; have good record as cost reducer; good handler of men. Box 895, AM. M.

OHIO

Working tool foreman, 11 years' experience with leading manufacturer of brass goods, desires change; references furnished on request. Box 865, AMERICAN MACHINIST.

Works manager or general manager, by man of wide shop and office experience in manufacturing, with first class firms; have good control of men and have had full charge of manufacturing in two large plants in last 14 years; will be available September 1; special experience in drafting room, pattern shop, foundry, brass, steel and iron, machine shop, boiler shop and structural shops; can give high class references. C. B. A., AMER. MACH.

PENNSYLVANIA

Tool draftsman and designer with shop experience, desires to change; Philadelphia or vicinity. Box 882, AMERICAN MACHINIST.

FOR SALE

For Sale—Nearly new No. 16 oven furnace. Mr. Wales, Keene, N. H.

For Sale—Electric welder Toledo No. 3, with spot welding jaws; new February, this year; capacity $\frac{3}{4}$ inch; thoroughly overhauled. F. H. Brown, 103 Chandler Ave., Detroit, Mich.

Four thousand dollars will buy a light manufacturing machine shop, brass foundry and plating works, doing a safe, steady, profitable business in this city; established twenty years; health only reason for selling. For full information address Hoyt Investment Company, 4290 Queen Ave., South, Minneapolis, Minn.

For Sale—Three return tubular boilers, manufactured by Riter Bros., Buffalo, N. Y. Drums 72x16 feet 0 inches; each boiler with sixty-six 4-inch tubes; inspected by Travelers Indemnity Company, of Hartford, Conn; 93 lb. steam pressure; boilers in good condition; can be delivered in two to three months, and seen in operation at Buffalo Bolt Company's plant, North Tonawanda, N. Y.

For Sale—Second-hand, fifty-horsepower gas-producer plant and engine, used to run our work two years, good as new, by a first-class manufacturer; may be tested as now set up and in running order in our shop; laid off because it cannot compete with electric motors; cost us over $4000; price, $2500, f.o.b., Philadelphia. Philadelphia Gear Works, Inc., 1122 Vine St., Philadelphia, Pa.

An opportunity to start a machine shop; we offer one of our departments for sale, the one used to establish our business; it is small and profitable work, but as we are devoting ourselves to heavier work, we offer to sell for $2000, all the drawings, patterns, and stock of finished and partly finished parts and rough material (inventories over $3000), circulars, electrotypes, special machinery and fixtures, and an established trade. Address Sipp Machine Company, Paterson, N. J.

For Sale—One Nash gas engine, 20 horsepower, two cylinder, for electric lighting, pumping or power; one Beaman & Smith horizontal boring mill; table 25 inches wide, 36 inches long; will bore 12 inches diameter, 24 inches long, and face 20 inches diameter; one 300 light J. B. Colt Co. acetylene gas apparatus. The above machines are in excellent condition, having been very little used. For further particulars and prices apply to Rider Ericsson Engine Co., 35 Warren St., New York.

For Sale—Established machine tool business in the north of England; valuable patents and modern plant; will prove a first rate addition to an existing business or nucleus for foreign patentees requiring established business and works; leases and options in buildings transferred if required. Communications from principals only to be addressed in first instance to "M. T. Business," Care Messrs. Patersons, Snow, Kinder & Lawson, 25 Lincoln's Inn Fields, London, W. C., England.

Talks With Our Readers

By the Sales Manager

Some of us look at the advertising in a paper one way. Some another.

Some make use of it in one way. Some another.

We ran across a man a while ago who put these pages to practical use, just as soon as he got them.

He was a superintendent in a shop in the Middle West, employing about 200 men.

* * *

When he received a copy of the AMERICAN MACHINIST each week he looked at the advertisement of the Cincinnati Milling Machine Company and took it out to the foreman of the milling machine department.

The cuts showed them how to set up the machines; the correct position in which to put the work on the table.

Then he compared the time and cost of operation with those given in the advertisement.

He knew that if his men were not coming up to it something was wrong.

He was particularly interested in this department at that time, and these advertisements formed a standard in milling-machine practice in this shop.

There must be standards in machines as there must be laws marking the dividing lines of individual liberty and conduct.

These standards to be effective must be known.

The Cincinnati Milling Machine Company are standardizing their product by making it known to users.

And then making good.

* * *

Why should we buy a machine?

Why should we choose a certain make from among the 57 varieties?

Should we buy one because it's "in the Hall of Fame?"

Another because "it is the machine of quality?"

Because "it's unequaled for speed, safety and dependability?"

* * *

Such pretty phrases glide off our minds with the facility that water glides off the new waterproof beltings.

They don't create a conviction in favor of the particular machine each of them is supposed to advertise.

The kind of reasoning we are sure to get from a good salesman.

We want to know what a machine will do.

How it does it.

What its product costs.

We want to be so fortified with facts and evidences about the good points of a machine that, if necessary, we can defend the machine against the arguments of a salesman of a competing machine.

* * *

Some say we haven't time to read the selling arguments in an advertisement.

That's the plea of those who are satisfied to put general publicity in an advertisement when they can get that and a direct selling educational force combined with it.

We have time to read anything that tells us convincingly how to do our work cheaper, faster or better.

All we ask is that it's interesting.

It must be truthful if it appears in the AMERICAN MACHINIST.

* * *

Say you saw it in the American Machinist,

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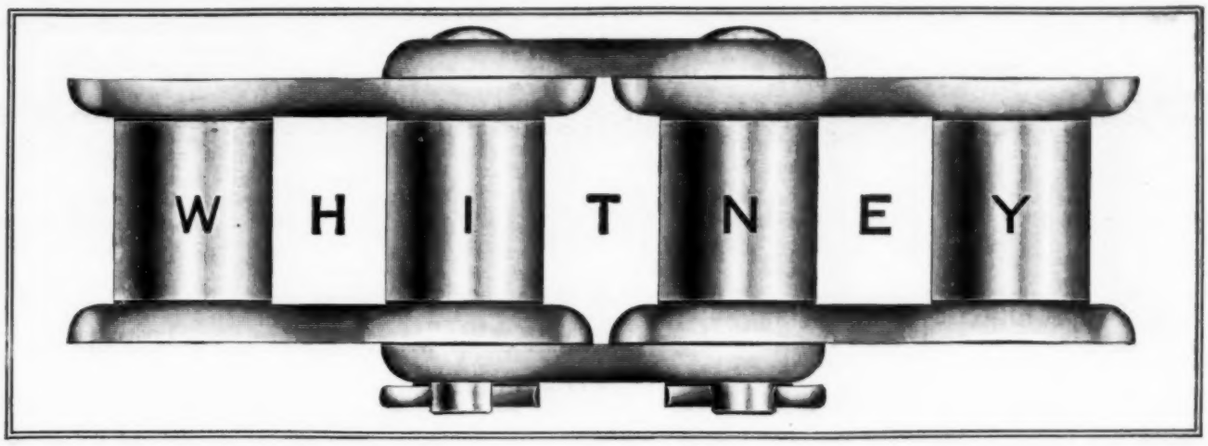

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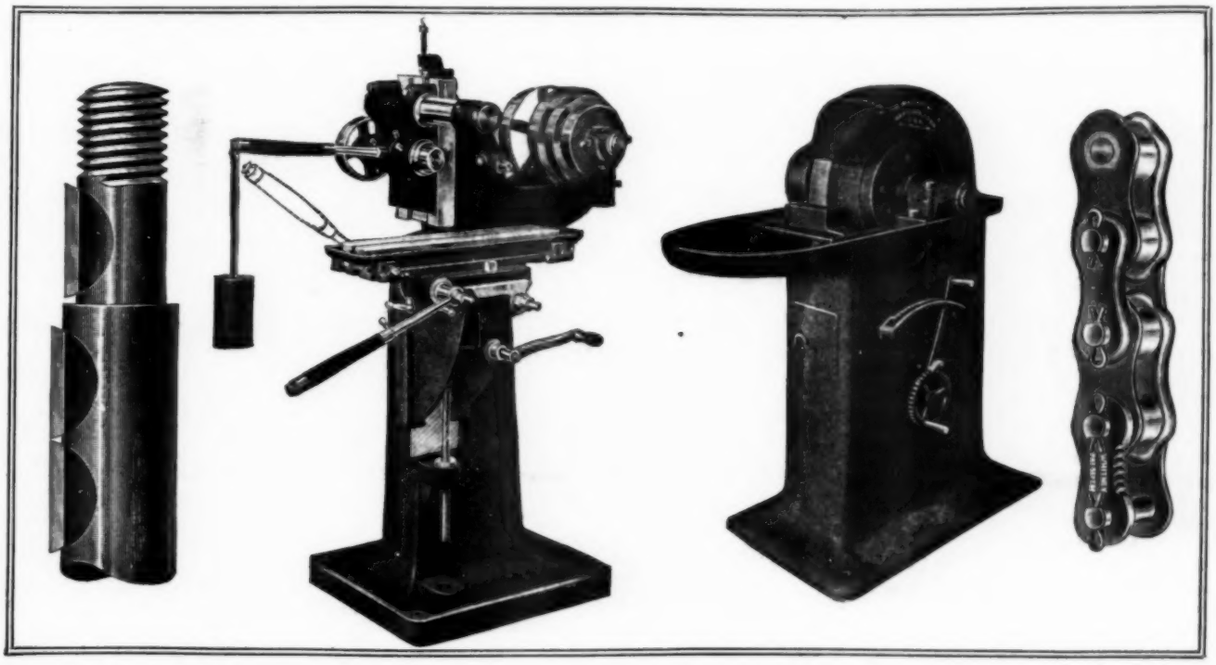

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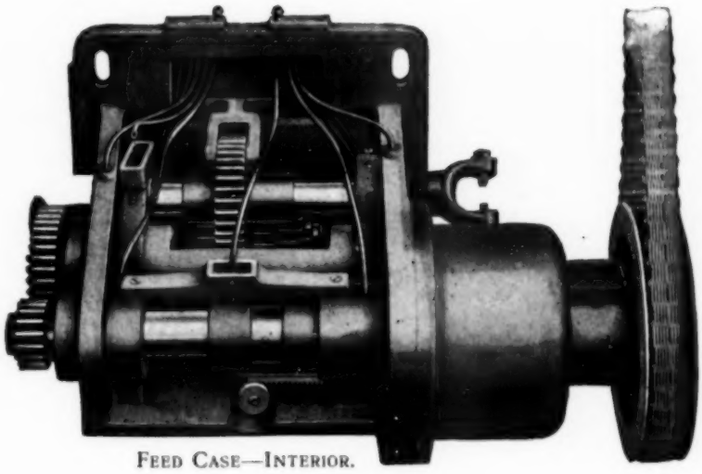
The following facts show how the high efficiency is obtained in the speed and feed cases of

B. & S. Constant Speed Drive Milling Machines



FEED CASE—INTERIOR.

1. All of the supporting parts, shafts and gears, are heavily proportioned so that all vibration is eliminated, even when the machine is taking heavy cuts.

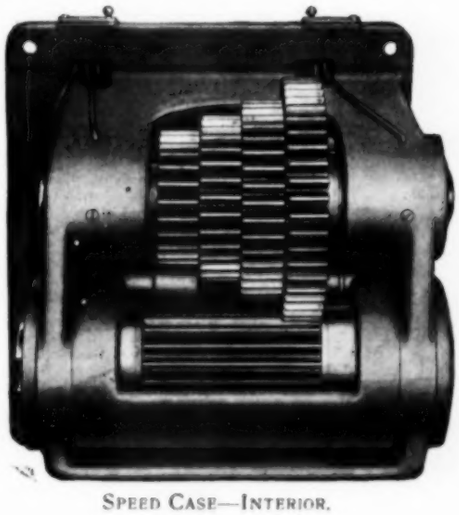
2. Ample oiling facilities for the bearings are provided in a simple and direct manner by two reservoirs, as shown in the cuts.

3. The special design of the gears, made with pointed teeth and chamfered edges, assures instant engagement without the employment of auxiliary mechanism.

4. All gears are of machinery steel, hardened, and with the holes ground concentric with the pitch circles after hardening.

5. The shafts are also hardened, of steel ground and supported firmly close to points where pressure is applied.

6. Changes in feeds and speeds are made by a simple shifting of levers. The plates that show the different arrangements of gears for the various feeds and speeds have no confusing combinations of letters and numbers to be considered.



SPEED CASE—INTERIOR.

Send for "Features of the Original Constant Speed Drive Milling Machines."

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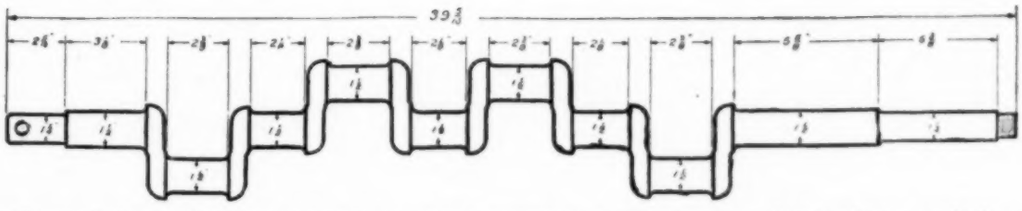
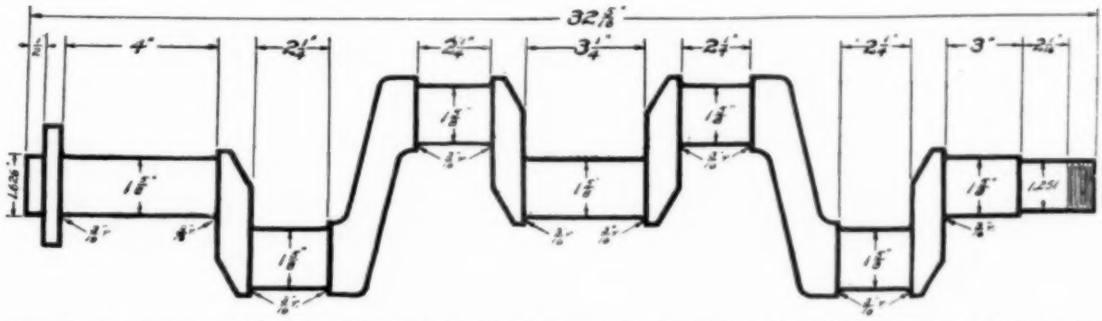


Grinding Time 90 Min. Material, nickel steel. Stock removed, .030" diameter. Limit of size variation, .0005"



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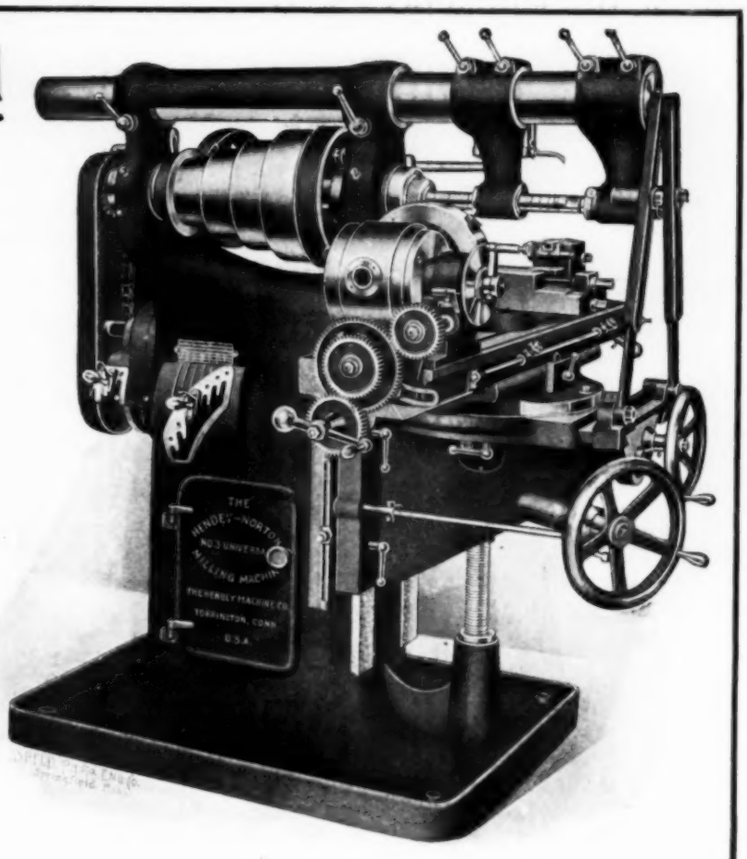

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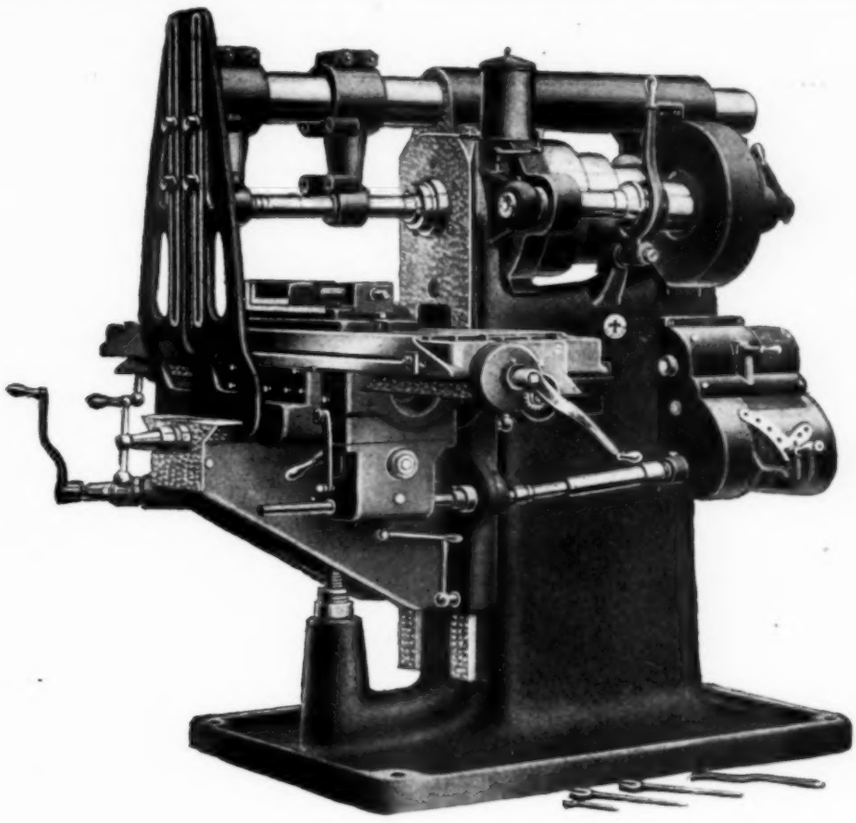

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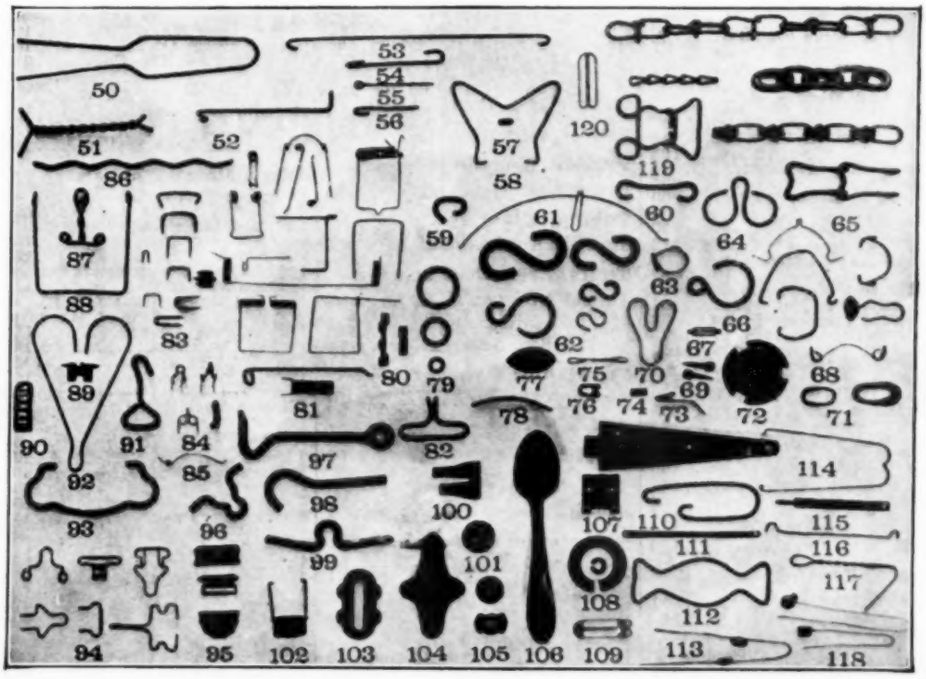

50 Wire handle. 51 Twist wire. 52 Special. 53 Links. 54 Links. 55 Screw eye blank. 56 Screw eye blank. 57 Side for bicycle chain link. 58 Special. 59 Dredge link. 60 Link. 61 Neck wire. 62 S. hooks. 63 Hose clamp. 64 Finger ring. 65 Chain. 66 Chain hook. 67 Buckle. 68 Bottle wires. 69 Button fastener. 70 Wire shape. 71 Repair links. 72 Sheet blank. 73 Trap wire. 74 Umbrella spring. 75 Fish line swivel. 76 Corset fasteners. 77 Fish hook spoon. 78 Spring. 79 Flat and round rings. 80 Umbrella clamp. 81 Mouse and rat trap wires. 82 Belt Hook. 83 Staples. 84 Hooks and eyes. 85 Piano wires. 86 Crimped wire. 87 Hook. 88 Trap wire. 89 Eyelet. 90 Shoe fastener. 91 Hook. 92 Special. 93 Drawer or chest handle. 94 Suspender and trouser buckles. 95 Suspender buckle plates. 96 Bottle wire. 97 Iron hook. 98 Blank hammock hook. 99 T bar. 100 File wire holder. 101 Button back. 102 Bottle cap. 103 Sheet metal form. 104 Portier pole bracket. 105 Curtain pole plates. 106 Spoon. 107 Hinges. 108 Check washers. 109 Hose supporter. 110 Tie wire. 111 Seal wire. 112 Special shape. 113 Neck wire. 114 Gas mantle wire. 115 Harness wire. 116 Link. 117 Bag tie. 118 Car seals and wires. 119 Belt Hook.

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